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AGRICULTURAL REVIEW

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The Philippine Agricultural Review

SPECIAL ARTICLES

◆

ANNONACEOUS POSSIBILITIES FOR THE PLANT BREEDER

By P. J. Wester

EFFECT OF THE 1912 DROUGHT AND TYPHOONS AND THE MAY TYPHOON OF 1913 ON THE PRODUCTION OF ABACA (MANILA HEMP)

By M. M. Saleeby

RECENT PROGRESS IN HORTICULTURAL WORK AT THE SINGALONG EXPERIMENT STATION

By O. W. Barrett

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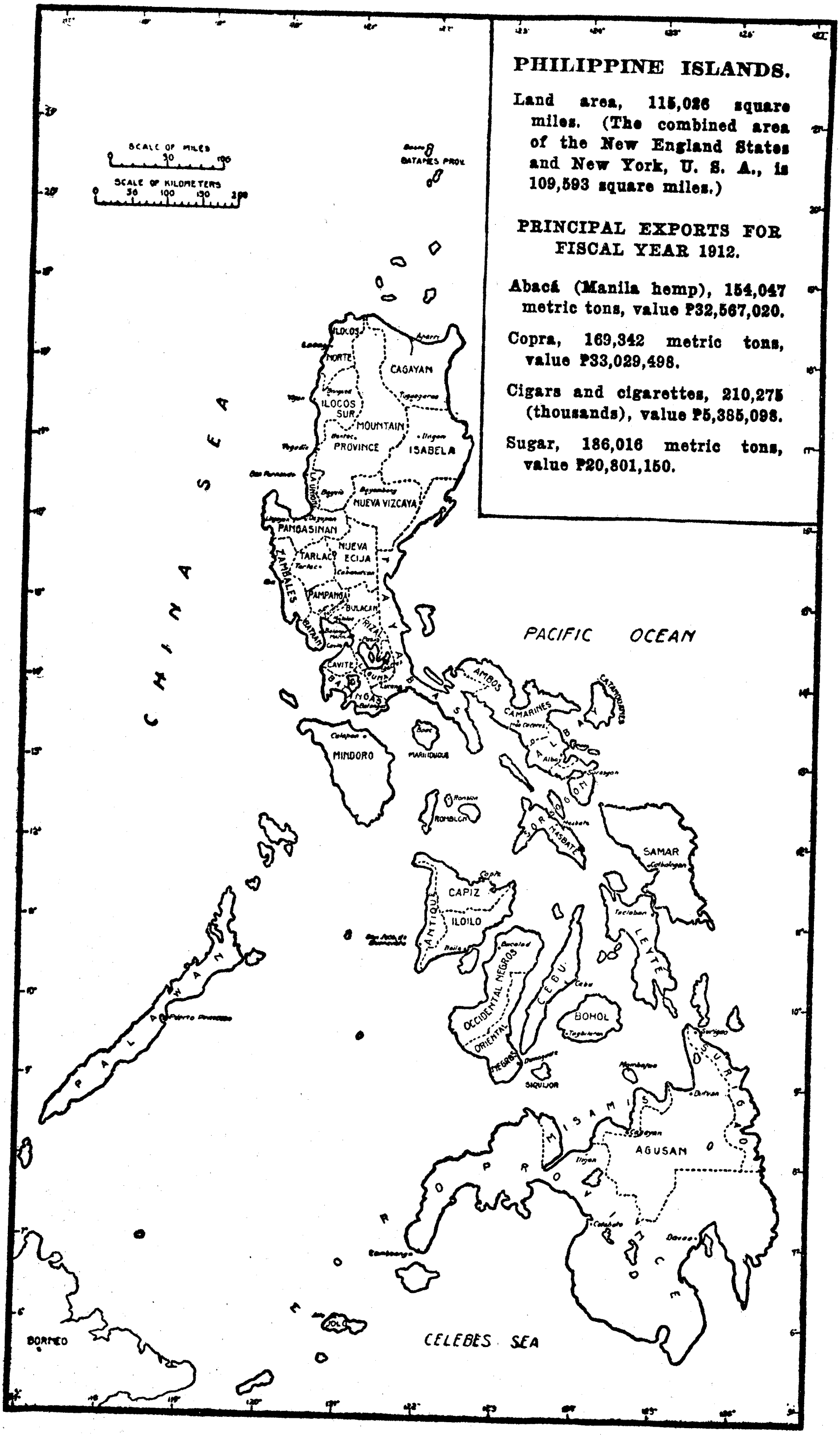

PHILIPPINE ISLANDS.

Land area, 115,026 square miles. (The combined area of the New England States and New York, U. S. A., is 109,593 square miles.)

PRINCIPAL EXPORTS FOR FISCAL YEAR 1912.

Abacá (Manila hemp), 154,047 metric tons, value ₱32,567,020.

Copra, 169,342 metric tons, value ₱33,029,498.

Cigars and cigarettes, 210,275 (thousands), value ₱5,385,098.

Sugar, 186,016 metric tons, value ₱20,801,150.

Trial grounds at the Singalong experiment station.

THE PHILIPPINE

Agricultural Review

VOL. VI JULY, 1913 NO. 7

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EDITORIAL.

AGRICULTURAL CONSERVATISM.

Experimentation, elimination, selection—by these processes science moves on from point to point. Unfortunately, there are no short cuts for working out theories, laws, and solid facts regarding natural history subjects; it is easy enough to guess and theorize and correlate, and often there is no harm in so doing, but the conservative student looking for the genuine crystallized fact must needs try out, discard, and select.

When we ask a question of Nature—that is, make an experiment—we always receive not one but several answers; and thereby, through our limited powers of reasoning and selecting, comes the eternal trouble, as well as the pleasure, in scientific work. A new crop or fruit for the planter, a new way to destroy locusts or termites, a new kind of vegetable or flower, a new type of breeding animal—all these must be *tested* by some one before they have a right to go before the public as "inspected-and-passed" objects or ideas of value.

The world is rapidly—in the last two decades—coming to believe that this trying-out work should be done by Government institutions, the results to be given to the people as soon as it may be safe to do so. Naturally, then, the public has come to expect nothing but the plain, unvarnished truth regarding the results obtained through the Government's experimental work; opinions tinged with either optimism or pessimism do escape sometimes, but, in the long run, are usually harmful. A peso warned away from a losing venture is almost as good as the laboriously earned one; on the other hand, experience is worth something if it be not too discouraging. By the same token, also, it is obvious that the Government, rather than the private agriculturist, should meet the discouraging features and run the risk of financial loss in these efforts to learn just what is best.

Therefore, the practical evidences of the Bureau's work results, whether in the shape of a new vegetable, a new way to grow good maize, or abacá, or coconuts, a new way to control animal diseases or locust outbreaks, or any other improvement that makes for economy to the planter, stock owner, or agricultural investor, may always be accepted as the *best* for the *present.*

ANNONACEOUS POSSIBILITIES FOR THE PLANT BREEDER.[1]

By P. J. WESTER, *Horticulturist.*

One of the chronic complaints of the average Caucasian in the Tropics, the American in particular, is that of the inferiority and the scarcity of the fruits of the country in which he sojourns in comparison with those of the Temperate Zone. Unquestionably this attitude is to a very considerable extent governed by the circumstance of early associations, and because he has been accustomed to certain fruits, such as the apple, peach, and pear, since infancy, which differ greatly from the tropical fruits in composition, flavor, and aroma—even though it cannot be gainsaid that in the number of sorts and in their availability, the Temperate has the advantage over the Torrid Zone. This is partly due to the fact that the temperate fruits have been for centuries subject to breeding and good culture, and again, fruit culture in the Tropics has never been conducted along such lines and on such an extensive scale as in the native home of our complainant, not to mention the fact that so many of the tropical fruits do not have the keeping qualities possessed by several of their rivals in the North and South by which their season is greatly prolonged.

As a matter of fact, the equatorial belt has been far more generously treated by a kind Nature with a multitude of distinct species of plants bearing edible fruits than the rest of the world —with raw material of which good fruits are made, as it were. Let us not forget that the three fruits which have been considered the best in the world—the cherimoya, the pineapple, and the mangosteen—are all tropical in origin, not to speak of many others which are hardly inferior. Considering the care the trees receive in the Tropics, the quality of the fruit produced is remarkable; that this fact again holds in store still greater promises for the patient and intelligent plant breeder, no one who is conversant with the subject will deny. Everything taken into consideration, the absence of good culture, intelligent selection of seed, and, above all else, for all practical purposes, vegetative propagation, excepting in the banana, pineapple, and ceriman, the quality of the tropical fruits may well be a source of wonder instead of an object of deprecation.

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[1] For complementary articles on the annonaceous fruits by the same author consult "Pollination experiments with anonas," Bul. Torrey Bot. Club, 37, pp. 529–539, 1910. "A contribution to the Nomenclature of the Cultivated Anonas," Philippine Journal of Science, Vol. VII, No. 2, Sec. C, pp. 109–124, 1912. "Annonaceous Fruits and their Propagation," Philippine Agricultural Review, Vol. V, No. 6, pp. 298–304, 1912.

Many of the best varieties of the temperate fruits originated in fence corners, literally and figuratively speaking, and they owe their present-day existence and fame solely to the fact that they grew in a country where grafting and allied arts were known. In the Tropics, these means of propagation are still almost unknown and practically never in vogue. The more's the pity, for who can tell how many most excellent varieties of tropical fruits have therefore been lost to us?

One of the most interesting groups of plants to which the plant breeder in the Tropics may devote his attention is the genus *Annona,* including some 60 or more species, and the closely related *Rollinia,* with over 20 species, belonging to the family Annonaceæ, of which an unusually large number of species bear edible fruits. There is also one species of *Duguetia* and some belonging to the genus *Uvaria* whose fruits are known to be edible. The papaw, *Asimina triloba,* is the only plant of this family in the Temperate Zone that may be considered as having possibilities for the plant breeder. Altogether, it is doubtful whether there is any other genus which contains so many species having edible fruits as the genus *Annona.* Already Linné seems to have anticipated this when he created the genus, for the name *Annona* signifies "provisions;" it is not, as generally believed, derived from the pre-Linnean name "Anona," which, after Linné, superseded *Annona,* in our days again being set aside for its older rival. Rumphius believed that "Anona" was a derivation of the Malay word Manoa or Menona, but Nieremberg, an older author, states that the name Anona was applied to all annonaceous fruits in Santo Domingo by the inhabitants. Considering that Oviedo already some two hundred years before Rumphius also referred to the sugarapple under the name "Hanon," sometimes spelled "Anon," there is but little doubt the name Anona is of American origin.

In connection with the fact that 9 fossil species of *Annona* have been discovered in Tertiary deposits in Europe, it is interesting to note that nearly all the Annonas and all the Rollinias so far described are indigenous to the New World.

Several species of the genus *Annona* have long been in cultivation; but it seems that only one species of *Rollinia,* the biriba, has been domesticated, and this only locally where it is indigeneous; so far as the writer is aware the species has not been introduced into foreign countries until within a comparatively few years. Yet, Huber says that in Pará the biriba thrives better than any annonaceous fruit in cultivation in that country, succeeding well both in exposed and shaded situations. According to him it was already in cultivation in Pará in 1662.[1] Everything considered, it seems remarkable that such a superior fruit as the biriba is reported to be, and one so easily propagated and grown, has not, like several of the Annonas, become more widely distributed to other parts of the world.

The two genera *Annona* and *Rollinia* are very nearly related and many species in each genus closely resemble one another. That this close relationship is more than superficial is shown by the fact that at least one species of *Rollinia,* the biriba, makes a most satisfactory growth on the mamon (*A. glabra* L.), and the writer also, a year ago, experimentally budded the biriba on the soursop and the custardapple. These two combinations appear to be the less congenial, for, although the growth is healthy and normal, the vigor of the top is greatly reduced.

The quality and flavor of the many edible Annonas and Rollinias is highly divergent, some being sweet and others acid, some distinguished by the attractive coloring of their exterior and flesh, and others possessing a hard, shell-like rind that enhances the shipping qualities of the fruit, while in still others aroma and flavor are highly developed. Then again, certain species grow at high altitudes and are cold resistant—an invaluable characteristic in the subtropics visited by frosts; some possess unusual vigor; and still others inhabit swampy and inundated regions incapable of growing other fruits, while others succeed on high and well-drained land; and many deserve recognition for their decorative value; in fine, the variability of the fruits and the characteristics and habits of the species in the two genera under consideration are indicative of a wider range of potential possibilities of attainment by their intelligent hybridization than almost any other group of plants.

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[1] Huber, J. Notas sobre a Patria e Distribuçao Arvores Fructiveras do Para. 1904, p. 391.

It is frequently said that there is nothing new under the sun, and the present instance is merely another verification of the truth of this old proverb; for it is interesting to note that the possibilities of amelioration of the wild species of *Annona* and *Rollinia* by selection, vegetative propagation, and improved cultivation were recognized nearly one hundred years ago by the botanist St. Hilaire. However, St. Hilaire was that many years in advance of his time, for the field is still practically virgin and it remains for this and future generations to realize his anticipations.

In 1908, at the subtropical laboratory, Miami, Fla., U. S. A., the writer successfully hybridized the cherimoya and the sugarapple, the sugarapple and the custardapple, the cherimoya and the mamon, and the mamon and the sugarapple. Several hundred seedlings resulted from this work, part of which were planted out in 1910, the hybrids between the cherimoya and the sugarapple showing remarkable vigor and thriftiness. In 1911 hybrid seeds of the same combination from a cross made in 1910 were brought to the Philippines and the seeds sown in March of the same year. These hybrids exhibited the same remarkable vigor and some attained a height of 2.3 meters in one year and bloomed when they were 16 months old. No fruits resulted, however. This year, in the course of the reorganization work at Lamao, where the plants are growing, it became necessary to transplant the hybrids and their fruiting is on that account unfortunately delayed for another year.

Most of the notes incident to the preparation of this paper were collected in Washington, D. C., in 1909 and 1910, and it is a pleasure to the writer to acknowledge his indebtedness, for translations of many passages in foreign publications consulted upon the subject under consideration, to Dr. Audrey Goss, then of the Bureau of Plant Industry, United States Department of Agriculture, and now of the John Crerar Library of Chicago.

The writer is greatly interested in the study and the amelioration of the economic plants belonging to the family Annonaceæ and will esteem as a great favor the receipt of any information relative to these plants that readers of this paper may consider of interest. Seeds of Annonas, Rollinias, and Uvarias will also be gratefully received.

The collectors of herbarium material and traveling botanists naturally failed to find mature fruits of many species, and our information in regard to the fruits is, therefore, very meager. It is regrettable that they have so frequently neglected to state the habit of the plant and its habitat; their descriptions, therefore, frequently fail to give any clue to the economic value of the plant, so important to the breeder. From what has been gleaned from the widely scattered literature on the annonaceous plants, those referred to below are believed to be species worthy of introduction and cultivation for breeding work, for testing as stocks for the species already in cultivation, or for ornamental purposes; it is quite probable that there are several others that, when better known, may also be found to be of more or less value. Common names have been given whenever found in the description of a species. Wherever one species has been found to have several popular names, the shorter or most attractive has been retained.

1. *Annona barteri* Benth.—A large tree, attaining a height of 15 meters, bearing a fruit 4 to 5 centimeters in diameter, growing on the banks of the River Niger, Africa.

2. *A. cacans* Warm.—Araticú Cagão. An attractive tree, upwards of 18 meters tall, with a fruit 8 to 10 centimeters in diameter, subglobose, greenish, glauco-pruinose; the flesh is edible. Araticú Cagão is indigenous to Brazil.

3. *A. cauliflora* Mart.—A vigorous tree, indigenous to the State of Bahia, Brazil, where it attains a height of 9 or more meters.

4. *A. cherimolia* Miller (*A. tripetala* Ait.).—Cherimoya. A tall shrub or small tree, 4.5 to 10 meters high, with ovate-oblong, velvety leaves. The fruit is variable in size and appearance from that of a large apple to 5,000 grams in weight, irregularly heart-shaped, greenish or yellowish, ferruginous tomentose, areoles more or less distinct, carpids depressed, equal or raised; the flesh is whitish, sweet, subacid, rich, melting, and aromatic. The cherimoya succeeds best on well-drained land and is a native of Ecuador, Colombia, Central America, and perhaps Mexico, but is now widely distributed throughout the Tropics and subtropics. The cherimoya is famed as one of the three most delicious fruits in the world. The extreme variability of this species is well illustrated in Plates II and III.

5. *A. cornifolia* St. Hil.—Brejo. A tall shrub, attaining a height of 4.5 meters; the fruit is about the size of an egg, ovate-globose, glabrous to subvillose, and orange red in color, the flesh sweet and edible. *A. cornifolia* is indigenous to southern Brazil and Paraguay.

6. *A. crassiflora* Mart. (*A. macrocarpa* Barb. Rodr.), (*A. rodriguesii* Barb. Rodr.).—Marolo. A shrub or tree, with tortuous branches, 3 to 6 meters tall, indigenous to Brazil, where it grows from sea level to an altitude of 800 meters. The fruit is globose, conical, 13 to 14 centimeters in diameter longitudinally, yellowish green, ferruginous tomentose, areolate, with prominent carpels; the flesh is white, sweet, of agreeable flavor, and aromatic. The fruit is eaten raw and also used in making a drink. There is a variety of this species the pulp of which is yellow instead of white.

7. *A. dioica* St. Hil. (*A. cuyabaensis* Barb. Rodr.).—A shrub, described as bearing a conical fruit about 4 centimeters in diameter, while according

to another author the species has a large fruit from which a very agreeable drink is prepared by the natives. This discrepancy of statements may be accounted for by there being different forms of the species. Indigenous to Brazil.

8. *A. diversifolia* Safford.—Ilama. A tree indigenous to Mexico, having a grayish-green fruit with cream-colored edible flesh.

9. *A. excelsa* H. B. K.—Ilama. A large tree of vigorous growth, 15 to 18 meters in height. The writer has failed to find any description of the fruit, which, however, must be of considerable value, since Foex mentions when it is in season and enumerates eight states in Mexico where the species is cultivated. The Ilama occurs in northwestern South America also and probably in Central America.

10. *A. fœtida* Mart.—A shrub, attaining a height of 3.5 meters or more, bearing a fruit of about the size of a goose egg, ovate to subglobose, dark rose red in color; the species is indigenous to Brazil. Inferentially Martius seemed to consider the fruit inedible, but otherwise very similar to

11. *A. furfuracea* St. Hil.—Araticú do Campo. A shrub 1 to 2 meters tall; the fruit has the size of an apple and is edible. Native of Brazil.

12. *A. geraensis* Barb. Rodr.—Marollinho. A shrub, 1 to 2 meters high, with yellow flowers, indigenous to Brazil; the fruit is described as large and aromatic with white flesh.

13. *A. glabra* L. (*A. palustris* L.), (*A. laurifolia* Dunal).—Mamon. A tall shrub or a small tree of vigorous growth, sometimes exceeding a height of 7.5 meters, with oblong-oval or obovate, glabrous, leathery leaves. The fruit is cordiform, 6 to 12 centimeters long, moderately smooth, undulate, yellowish or brownish; the flesh is an attractive rich, creamy yellow, and barely edible. The mamon, indigenous to tropical America and Africa, is, together with the sugarapple, custardapple, and the soursop, one of the oldest known species in the genus. The mamon has been found to be a satisfactory stock for the cherimoya, the custardapple, and the soursop, and appears promising for the biriba also. (See Plate VI.)

14. *A. hypoglauca* Mart.—A tree of vigorous growth, attaining a height of 6 to 9 meters, growing along the rivers in the State of Rio Negro, Brazil.

15. *A. ionophylla* Triana & Planch.—A species described from northwestern South America, where it grows at an altitude of 1,700 meters; the leaves of this species resemble those of the cherimoya and the flowers partake of those of the soursop. Unfortunately, there is no description of either the habit of the plant, its habitat, or the flowers.

16. *A. klanii* Pierre.—A tree, indigenous to Africa, attaining a height of 7 meters; the fruit is subrotund, 8 centimeters in longitudinal diameter.

17. *A. manirote* H. B. K.—Manirote. A shrub, about 3 meters tall, related to the soursop; the fruit is 15 centimeters in diameter, globose, muricate, and is edible. The manirote is indigenous to northwestern South America.

18. *A. muricata* L.—Soursop. A small handsome tree, 4 to 6 meters in height, with oblong-ovate or obovate leaves, dark green and shining; fruit irregularly ovate-oblong or conical, attaining a weight of 450 to sometimes exceeding 5,000 grams, greenish, with short, soft spines; flesh white, rather fibrous, subacid, juicy, and well flavored. The soursop is a very refreshing fruit eaten raw, and it makes excellent sherbet and a grateful cooling drink. The species is indigenous to the West Indies from whence it has that of *A. punctata*, which will be presently considered.

gradually spread to all parts of the Tropics. The soursop was the first species of the genus to be described and illustrated. (Plate V.)

19. *A. nitida* Mart.—A small tree, 6 meters tall, indigenous to inundated forests in Brazil.

20. *A. paludosa* Aubl.—Equinox. A low shrub, attaining a height of 1.5 meters; the fruit is of the size of an egg, ovate, tuberculate, and muricate, and yellowish in color; the flesh is whitish, juicy, melting, and of good flavor. The equinox is native to the marshy regions of Guiana.

21. *A. prestoei* Hemsley.—A robust tree with large leaves; the fruit is rather large, 10 centimeters in diameter, globose, fibrous and woody. Indigenous to tropical America.

22. *A. punctata* Aubl.—Pinanou. A tree, attaining a height of 7.5 meters, indigenous to Guiana, where it grows on the river banks; the fruit is ovate or subrotund, brownish, and punctate; the pulp is reddish and edible. Season, April and May.

23. *A. purpurea* Moç. et Sesse.—Soncoya. A tall, attractive shrub, upwards of 5 meters high. Opinions differ as to the value of the fruit of the soncoya, some pronouncing it superior to other Central American Annonas, while according to others the fruit is even deleterious, depending in all probability upon the fact that there is considerable variability in the species. The soncoya is a native of Mexico and Central America.

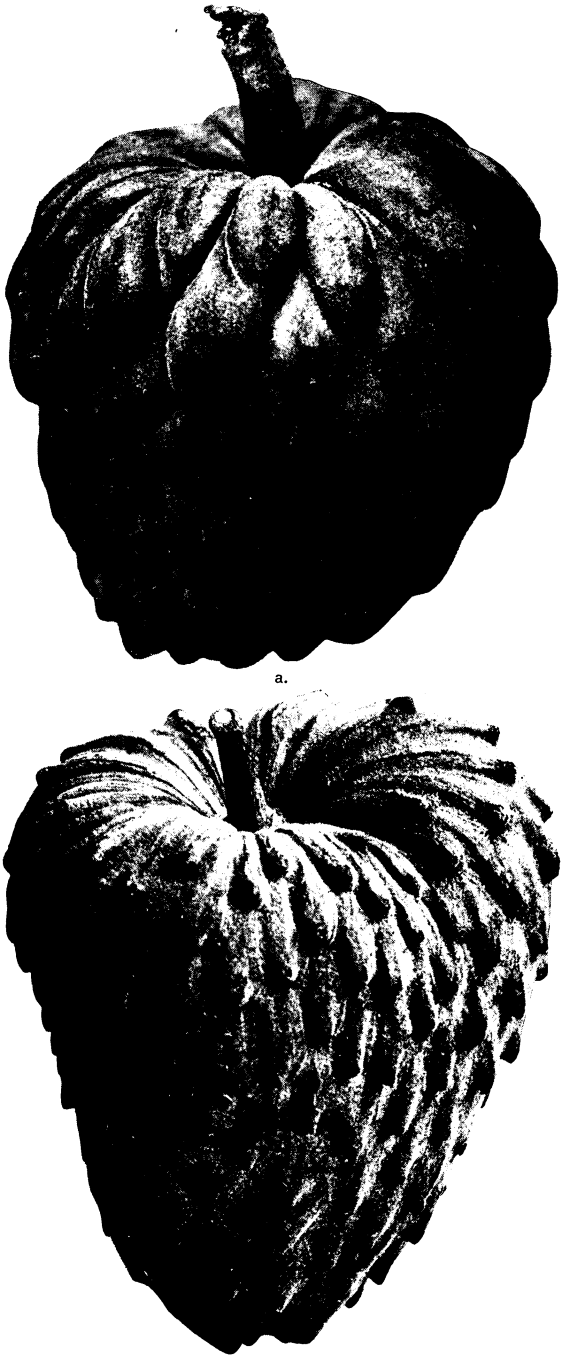
24. *A. quinduensis* H. B. K.—Cimarron. A shrub, 2 meters tall, indigenous to northwestern South America, where it ascends the Andes from an elevation of 1,000 to 2,340 meters. The fruit is of the size of an apricot. *A. quinduensis* was described as polygamous, but it seems likely that the description was made from abnormal flowers, and that the species is ordinarily hermaphroditic like its congeners. *A. dioica* St. Hil. owes its name to a similar mistake when that species was discovered.

25. *A. reticulata* L.—Custardapple. A small, rather attractive tree, 4.5 to 7.5 meters in height, with lanceolate, papery leaves. The fruit is 7.5 to 15 centimeters in diameter, cordiform, surface fairly smooth, greenish or yellowish with reddish reticulations. The flesh is a creamy yellow, rich, sweet, and melting, with a slight trace of acidity. The custardapple is indigenous to the American Tropics, but the species has long been well introduced throughout the entire equatorial belt. (Plate IV, *a*.)

26. *A. sanctæ-crucis* S. Moore.—Ata. A small tree, about 6 meters tall, of erect habit; the fruit is 6 centimeters in diameter, subglobose, tuberculate, greenish, of good flavor and well esteemed by the inhabitants. The ata is indigenous to Brazil.

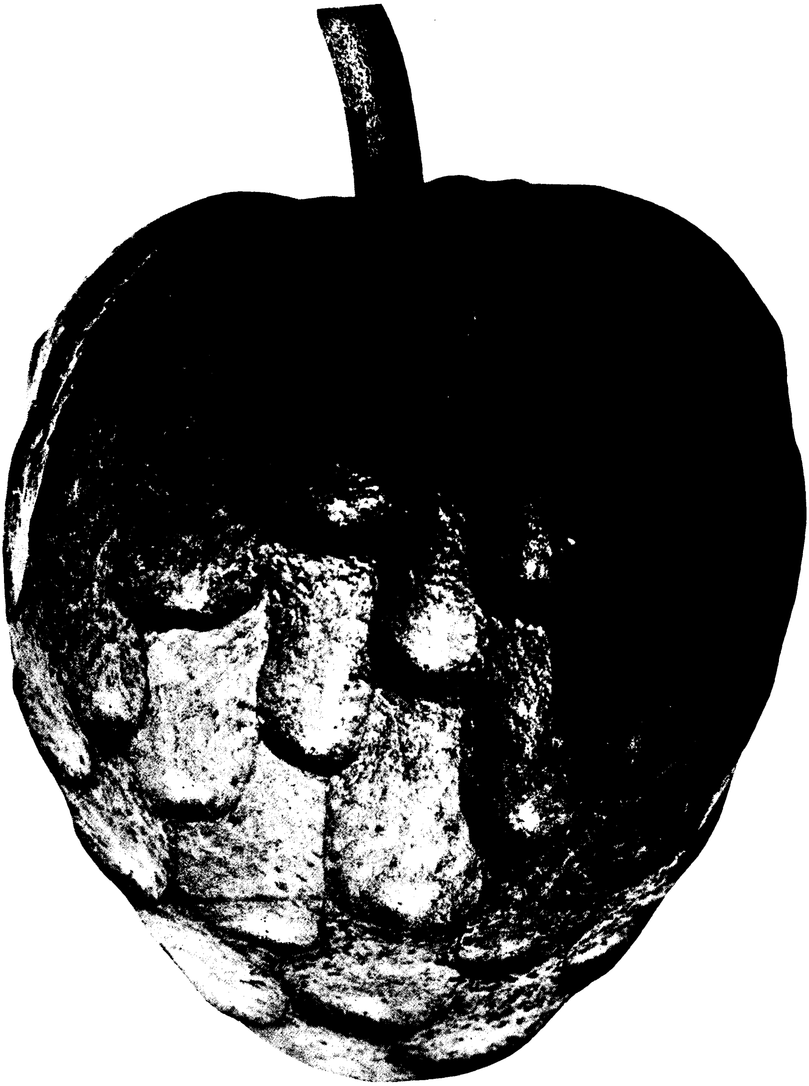
27. *A. senegalensis* Pers. (*A. arenaria* Schum. & Thonn.), (*A. chrysophylla* Bojer.)—Anigli. A small shrub or tree, sometimes attaining a height of 8 meters, indigenous to a large part of tropical Africa from the coast and ascending the Ruwenzori to an altitude of 2,600 meters. The fruit of the better kinds is 4.5 centimeters in diameter, subglobose, surface yellowish to orange; the flesh is scant, but sweet and aromatic, and the fruit has by some travelers been very much lauded, while others have pronounced it valueless. The anigli is exceedingly variable and the following distinct subspecies have been described: *A. s. latifolia* Oliv., *glabrescens* Oliv., *cuneata* Oliv., and *subsessiliflora* Eng.

28. *A. sericea* Dunal.—A shrub or small tree, 2 to 6 meters in height, growing in inundated forests, bearing cordiform, tuberculate fruits 2.5 to



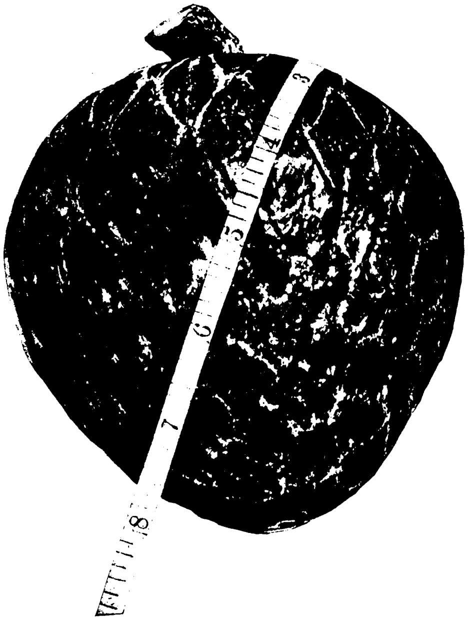
Types of cherimoyas (*Annona cherimolia* Miller), carpels prominent.

(Courtesy of Mr. David Fairchild, Bureau of Plant Industry, U. S. Dept. Agr.)

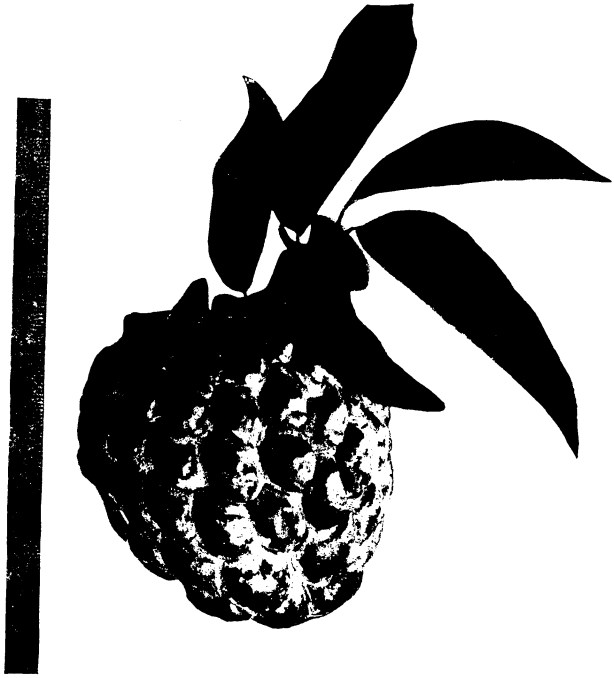


Type of cherimoya (*Annona cherimolia* Miller), carpels depressed.

(Courtesy of Mr. David Fairchild, Bureau of Plant Industry, U. S. Dept. Agr.)

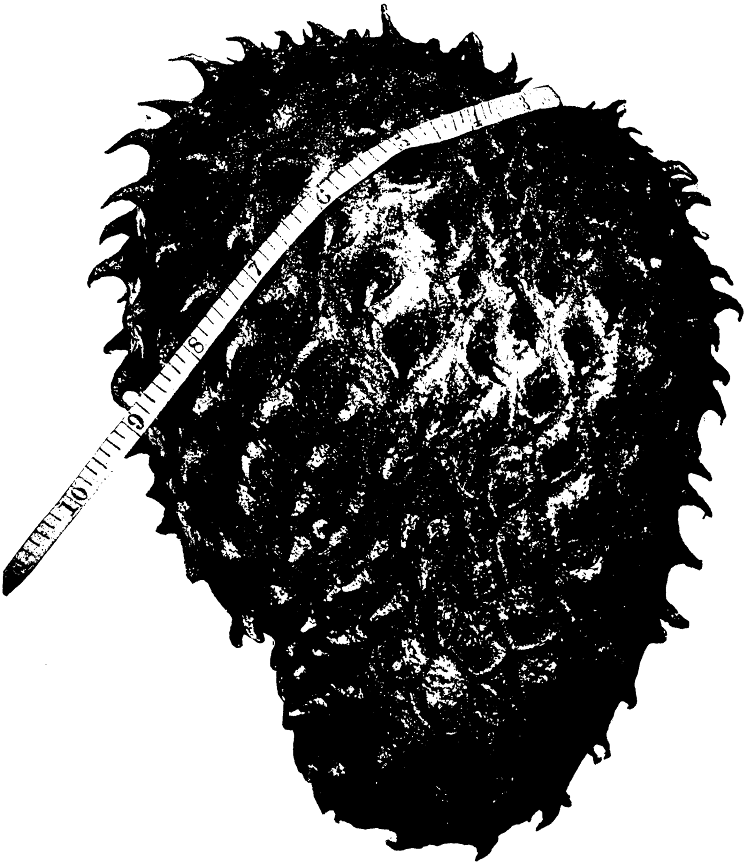


(*a*) The custardapple, *Annona reticulata* L.



(*b*) The sugarapple, *Annona squamosa* L.

(Courtesy of Bureau of Science).

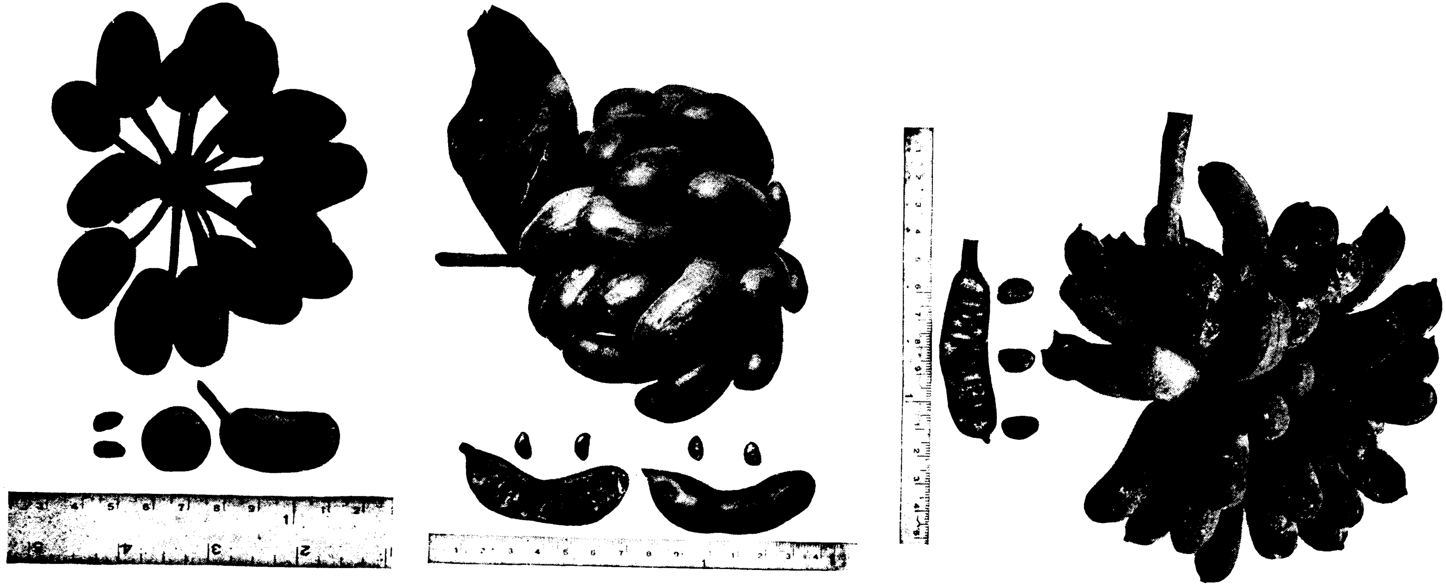


The soursop, *Annona muricata* L.

(Courtesy of Bureau of Science).

Biriba (*Rollinia orthopetala* A. DC.) shield-budded on Mamon (*Annona glabra* L.) (bud inserted in May, photographed in November).

PLATE VII.



(*a*) *Uvaria rufa* Blume. "Banauac."

(*b*) *Uvaria* sp. Susong Calabao.

(*c*) *Uvaria* sp.

Types of Philippine Uvarias.

3.5 centimeters in longitudinal diameter; found from the West Indies to Guiana and Brazil.

29. *A. spinescens* Mart.—Alagadisso. A shrub 3.5 meters high, growing on inundated land, indigenous to Brazil and southward. The fruit is 6 to 7.5 centimeters in diameter longitudinally, ovate, mucronate at apex, the surface faintly rose-colored, the flesh dry and insipid. The alagadisso is closely related to *A. cornifolia* St. Hil. A subspecies, var. *nutans* R. E. Fr., commonly called Araticú Ñu, that is, edible, has been described from Paraguay.

30. *A. squamosa* L.—Sugarapple. A tall shrub, 3 or more meters high, with oblong-ovate leaves, thin, and sparsely hairy; the fruit is irregularly heart shaped, 7.5 to 10 centimeters in diameter, tuberculate, greenish; the flesh is white, sweet, and delicately flavored, and the fruit is by some preferred to the cherimoya. The sugarapple is indigenous to tropical America, and has become more widely dispersed throughout the Tropics than any other species in the genus. Ever since the discovery of these five species, the cherimoya, the sugarapple, custardapple, soursop, and mamon, have been subject o an ever-increasing nomenclatorial confusion, the same popular name having been applied to two or more species with the inevitable result that even at this late day what is by one fruit grower considered to be a cherimoya is by another thought a custardapple and by a third a sugarapple, etc.[1] (Plate IV, *b*.)

31. *A. tenuiflora* Mart.—A tree, sometimes exceeding a height of 9 meters, indigenous to Brazil.

32. *A. uncinata* Sprague.—A tree 6 to 9 meters high; the fruit is ovoid-globose, uncinate, 4.5 centimeters in diameter; indigenous to Central America.

33. *A. vepretorum* Mart.—A tree indigenous to Brazil attaining a height of 7.5 meters; the fruit is 7.5 centimeters in diameter and has white edible flesh. *A. vepretorum* is related to *A. glabra* and *A. spinescens.*

34. *A. walkerii* S. Moore.—An erect shrub, 3 meters tall, indigenous to Brazil, where it grows in moist situations. The mature fruit is orange-colored and sweet.

35. *Rollinia cuspidata* Mart.—A tree attaining a height of 4.5 to 6 meters, growing along the banks of the Amazon River, Brazil.

36. *R. dolabripetala* (Raddi) St. Hil. (*R. longifolia* St. Hil.), (*A. xestropetala* Spreng.).—A tree, attaining a height of 6 meters, having a globose, scaly fruit, indigenous from Brazil and Guiana to the West Indies.

37. *R. edulis* Triana & Planch.—Tucuragua. A species bearing an edible fruit indigenous to northwestern South America, where it ascends the Andes to an altitude of 500 to 1,000 meters.

38. *R. emarginata* Schlecht. (*R. glaucescens* Sond.), (*R. sonderiana* Wlprs.).—Mirim. A slender, handsome shrub or a medium-sized tree, 3 to 10 meters high, with green coriaceous leaves; the fruit is globose, 2.5 centimeters in diameter or larger, and reported to be edible. The mirim is a very variable species, indigenous to Brazil and Paraguay.

39. *R. exsucca* A. DC. (*A. acutiflora* Mart.), (*A. exsucca* Dunal),

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[1] For a full discussion of the nomenclature of these species consult the Philippine Journal of Science, Sec. C, Botany, Vol. VII, No. 2, 1912.

(*A. haematantha* Miq.).—An attractive tree of vigorous growth, 6 meters tall; the fruit is small and dry. Indigenous to Guiana.

40. *R. laurifolia* Schlecht.—Araticú do Mato. A tall tree of vigorous growth, attaining a height of 15 meters, indigenous to Brazil; the fruit is subglobose, of about the size of a chestnut, pubescent; the flesh white, mucilagenous, and sweet.

41. *R. mucosa* Baill. (*A. obtusiflora* Tuss.), (*A. mucosa* Jacq.), (*R. sieberi* A. DC.).—A small tree, 5 to 7.5 meters high, very similar in habit and appearance to the custardapple, with which species it was frequently confounded by the older botanists; the fruit is tuberculate and not so well flavored as that of the custardapple. Indigenous to tropical America.

42. *Rollinia orthopetala* A. DC.—Biriba. A tree of rapid and vigorous growth, attaining a height of 10 meters; the leaves are 20 to 29 centimeters long, oblong-oblanceolate, acuminate, the young growth reddish or ferruginous pubescent; the fruit is cordiform with raised carpellary areas; Martius states that the fruit sometimes grows as large as a child's head, but according to modern botanists this is an exaggeration; the flesh of the biriba is white, sweet, and deliciously flavored; in fact, this has by some writers been declared to be the best of all the Brazilian annonaceous fruits. The native habitat of the biriba is the inundated banks of the Amazon River, Brazil. (Plate VI.)

43. *R. parviflora* St. Hil. (*R. fagifolia* Schlecht.).—A shrub or small tree, 4.5 meters high, indigenous to Brazil. Two varieties of this species are recognized, var. *latifolia* and *angustifolia*.

44. *R. rufinervis* Triana & Planch.—A very ornamental plant with beach-like foliage, indigenous to northwestern South America.

45. *R. sylvatica* Mart. (*A. sylvatica* St. Hil.), (*A. silvestris* Vell.).—Araticú do Mato. A shrub or small tree 2 to 6 meters in height, with a fruit of about the size of a medium-sized apple, globose and tuberculate, slightly pubescent, rind thick, the flesh juicy and well flavored. Indigenous to Brazil.

46. *Asimina triloba* Dun.—Papaw. A small tree, from 4 to 12 meters in height, indigenous to the eastern part of the United States, from Florida to New York extending to Kansas in the West. The fruit is oblong, smooth, the flesh is edible, subacid, and very aromatic. The papaw is the only species in the genus producing an edible fruit and is rarely cultivated; it has been budded on the mamon and if it is sufficiently closely related to its tropical congeners it might be used to impart hardiness to them by hybridization.

47. *Duguetia longifolia* Baill. (*Anona longifolia* Aubl.).—Pinaioua. A shrub or small tree bearing an ovate, subrotund fruit as large as a medium-sized apple, punctate, reticulate, nearly smooth, skin thin; the flesh is reddish, gelatinous, and "delicate" and contains a large number of small seeds. Indigenous to Guiana and Perú.

The Philippines are the home of a number of species of Uvaria, none of which are cultivated. The fruits of some of these are edible and are picked and marketed by the Filipinos, but are as yet in a greatly undeveloped state. The identity of these species, except one, is doubtful, as no complete herbarium material of them has been available for determination.

48. *Uvaria rufa* Blume.—Banauac; Susong Calabao. Fruits oblong, reniform, 3, sometimes 4, centimeters in length, in bunches of 18 to 20 averaging 115 grams in weight; surface bright red, velvety, ferruginous pubescent; skin thin, brittle; flesh scant, whitish, juicy, aromatic, subacid without a trace of sugar; quality rather poor; seeds many. Season, September. (Plate VII, *a*.)

49. *Uvaria* sp.—Susong Calabao. Fruits oblong, semireniform, in bunches of 30 to 50, weighing 300 to 550 grams; surface orange yellow, velvety, ferruginous tomentose; skin thin, but rather tough; flesh scant, yellowish, granular, and sweet, without distinctive flavor, acrid near the seeds; quality rather poor. Season, October. (Plate VII, *b*.)

The fruit of both these species is marketed in Manila.

Aside from the cosmopolitan Annonas, which have long been cultivated in the Philippines, the Bureau of Agriculture has introduced within the last two years several other species, such as the mamon, *A. glabra* L., the biriba, *R. orthopetala* A. DC., both described above, and *A. montana* Macf., a shrub or tree indigenous to the West Indies. The fruit of the last species is globose, greenish, with soft spines, and said to be inedible; because of the fondness of dogs for the fruit, this species is in Porto Rico called "Anona de Perro." *A. paraguayensis* R. E. Fries, is a little-known species of which seeds have been received and plants reared within the last three months; the seed and foliage characters show this species to be a very near relative to *A. reticulata.* In addition to the above, two species of *Annona* and two of *Rollinia,* all unidentified, have been received and are being brought to fruition at the Lamao experiment station.

A method used by the writer since 1904 to force seedling plants into early fruiting may be of interest to other experimenters, since it is applicable to practically all fruits and is extremely simple. Stock plants of vigorous species are reared and set out in their permanent positions in the test orchard awaiting their "charges," as it were. The seedlings of new introductions are planted out close to the large stocks, as soon as they are sturdy enough to be set out in the open, and, when established, they are inarched upon the larger plant. After the union is well formed the top of the stock is gradually removed and with the vigorous and well-established root system of the older plant the little seedling is forced into fruiting far earlier than if it had been set out and sustained by its own root system only.

EFFECT OF THE 1912 DROUGHT AND TYPHOONS AND THE MAY TYPHOON OF 1913 ON PRODUCTION OF ABACÁ (MANILA HEMP).

By M. M. SALEEBY, *Chief, Fiber Division.*

INTRODUCTORY STATEMENT.

A year ago this month the agricultural crops of the Philippine Islands in general were emerging from the deplorable ravages of a prolonged and unusually severe drought. This drought is generally conceded to have been the longest and severest in the memory of the present generation, and it was its uncommonness which alarmed both the producers and consumers of our agricultural crops, especially those produced for export. Of these export products abacá, copra, and sugar are by far the most important, and all have suffered to a greater or less extent from the drought in question.

In the fall of 1912 two rather severe typhoons occurred, which caused considerable damage to the crops in the provinces through which they passed. The October typhoon passed through Surigao, southern Leyte, southern and central Cebu, Bohol, northern Negros, and Capiz; and the November typhoon passed through southern Samar, northern Leyte, northern Cebu, and Capiz. It was fortunate for the abacá industry, however, that, of all the provinces hit by these typhoons, only one—Leyte—is a large producer of abacá.

Early in May of this year another typhoon occurred, which passed through Albay, southern Samar, Leyte, Mindoro, and the Ilocos Provinces, all of which, with the exception of the last two, are important producers of abacá.

Soon after the drought was over, and even before that time, the buyers and consumers of abacá were greatly concerned over its effect on the production of abacá. The prospects of a considerable shortage in the production of this important fiber and the strong demand for binder twine at the time caused by the prospects of good grain crops in the United States created an unusually strong demand for abacá. Even as early as June and July certain large consumers in the United States and Great

Britain attempted to determine the possible effect of the drought on the production of abacá by either sending representatives to the Philippines to investigate conditions on the ground or by delegating the task to their agents in Manila. In both instances the reports of such persons were based more on hearsay and on statements of some of the producers in certain affected districts than on actual conditions, and were consequently in most cases exaggerated and unreliable. Some reports, it is understood, estimated a general shortage from the drought alone at 50 to 60 per cent, which, if we were to add subsequent shortages from the typhoons, would cut down production to an almost negligible quantity.

In making such investigations three factors are absolutely necessary to enable a person to give an intelligent estimate. These are: First, a thorough knowledge of the condition of the plantations prior to the occurrence of the drought; second, sufficient training and experience in estimating the yield of fields of abacá; and, third, the reserving of a final opinion on the extent of damage until after the rains will have set in, in order to estimate more accurately the pèriod necessary for the plants to recover and resume their normal condition of growth.

The aim of this paper is to give a detailed account of the extent of the damage to the abacá plantations in the Philippines as a result of the drought and typhoons of last year and the recent typhoon of May of this year, combined with as approximate an estimate of the production of abacá during the fiscal years 1913 and 1914 as it is possible to give. It is admitted that such estimates can only be approximate, due to the absence of a regular and reliable crop-reporting service and to the peculiar conduct of Filipino farmers in such adverse circumstances as are encountered during and after the occurrence of typhoons and droughts. The estimates given in this paper are based on personal investigation through the Provinces of southern Luzon and Leyte, and also on official reports from these and other provinces.

CONDITION OF PLANTATIONS PRIOR TO DROUGHT.[1]

Simultaneously with the gradual fall in the price of abacá since the beginning of 1908 came a gradual decline in the condition of the industry in general. The high prices paid for the fiber between 1903 and 1907 had caused so much enthusiasm on the part of the producers that abacá was planted in any locality, under any conditions, and in any manner. While the price remained high the planters realized fair profits, but when the crash came many plantations were found to be so badly neglected, having poor soil, or managed under unfavorable conditions, as to make it impossible to realize any profits from them without the exercise of judicious methods of cultivation in some or a complete renewal of others. These methods, however, were not practised, and worse than that, whatever little attention had been given to the cultivation of the plants was gradually withdrawn, on the foolish plea that the price was too low to justify any such expense or trouble. In other words, instead of taking more interest in their farms and practicing more effective methods of cultivation and caring for the plants during the fall in price in order to increase the yield and better the quality of the product and make up for the difference in the price, the producers neglected their farms and looked upon any such efforts as unnecessary expense and wasted energy.

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[1] Reproduced from the Annual Report of the Director of Agriculture for fiscal year 1912.

Such has been the general condition of the industry between 1908 and the present time, and there has always been the danger that a calamity in the form of a severe typhoon or a prolonged drought might seriously injure the "lates"[1] and set back the industry in general. What was feared happened in both of the above forms, but fortunately the damage that resulted has turned out to be not so disastrous as it might have been.

PRODUCTION OF ABACÁ BY PROVINCES.

The production of abacá was 171,880 and 159,473 metric tons during the fiscal years 1911 and 1912, respectively. The production during the present fiscal year (1913) is estimated at not less than 145,000 metric tons. The exports of abacá are, as a rule, between 5,000 and 10,000 tons less than the production, which quantity represents the amount consumed locally.

Of the 159,473 metric tons produced during the fiscal year 1912, 48,128 tons, or 30 per cent, are accredited to Albay Province; 20,343 tons, or 12.75 per cent, to Ambos Camarines; 20,178 tons, or 12.65 per cent, to Sorsogon; 22,920 tons, or 14.4 per cent, to Leyte; 13,386 tons, or 8.4 per cent, to Samar; 8,696 tons, or 5.5 per cent, to Moro; 7,693 tons, or 4.8 per cent, to Misamis; 3,767 tons, or 2.35 per cent, to Surigao; and 14,362 tons, or 9.15 per cent, to all other provinces. From the above figures it appears that southern Luzon, Leyte, and Samar produced, during the fiscal year 1912, about 125,000 tons out of a total of 159,000, or over 78 per cent.

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[1] Plantations.

EFFECT OF DROUGHT AND TYPHOONS ON PRODUCTION.

Southern Luzon provinces.—The provinces of southern Luzon, namely, Albay, Ambos Camarines, and Sorsogon, have suffered from the drought more than the rest of the abacá-producing provinces. The damage, however, is more apparent in the "lates" situated on the lowlands, and along the bases and sides of the low range of hills to the westward, which extends from Albay clear up to Camarines Norte. Even in these localities the few lates that, previous to the drought, had been kept in good condition, now stand out in marked contrast to the others that had been practically neglected. The object lesson demonstrated there is so plain that it is hoped it would help in emphasizing to the bulk of the producers the importance and advantage of keeping their lates properly cleaned and in good condition. The largest, and by far the best producing, abacá lates in southern Luzon are those located along the bases of the volcanoes Isarog, Iriga, Masarag, Mayon, and Bulusan. There the lates can be safely said to have practically escaped the drought, and they appear as prosperous now as ever before. The only damage reported from these districts consisted in the growth of the plants being retarded while the worst period of the drought lasted; but after that was over they again resumed their previous normal condition.

The majority of the lates, situated in the lowlands too far to prevent them from participating in the benefits from the occasional showers of rain which were not infrequent in the localities nearer to the above-mentioned mountains, are at present in a serious condition. The drought is not alone responsible for the present condition of these lates, for alongside of these are to be found other lates which have stood the drought and have emerged from it in a much less damaged state and in much better prospects for recovering and resuming their previous normal condition. The reason why these have not suffered nearly as much as the former, though undergoing the same adverse circumstances, was the fact that they had been kept in a fairly good condition prior to and during the period of drought. The careful and regular cleaning of the plants and the judicious methods of harvesting have succeeded in enabling the old plants as well as the young shoots to withstand the dry spell and to resume their growth as soon as the rains set in. The short-sighted and ruinous methods practiced by the ignorant class of producers are, therefore, as responsible as the actual drought itself, if not more, for the present deplorable condition of most of the abacá lates.

In attempting to calculate the extent to which the abacá industry in the southern Luzon provinces was affected by the recent drought, it is, therefore, necessary to take into consideration the districts that were entirely, as well as those that were only partially, subjected to its influence. A thorough investigation along this line has convinced the writer that the various statements given out by several people interested in the abacá trade and fixing the expected shortage in production at 50 or 60 per cent are not well founded. It is, however, believed that a shortage of 25 to 30 per cent on last year's production can be reasonably expected. This shortage will probably extend until the end of the fiscal year 1914, after which conditions will probably improve until they are normal again about the beginning of 1915.[1]

Neither the October nor the November typhoon of 1912 touched any of the provinces of southern Luzon; and it was indeed very fortunate that they did not, as the majority of the lates were not in a condition to withstand the ravages of floods and strong winds.

The May typhoon of this year passed through Albay Province and is reported to have caused damages in certain parts to the extent of about 30 per cent, but this estimate is undoubtedly exaggerated. At the time this typhoon occurred the abacá plantations in Albay had either partially or entirely recovered from the effect of the previous year's drought, and consequently the damage could not have been as serious as it might have been had the typhoon occurred earlier. The shortage in production in this province caused by this typhoon will probably not amount to more than 15 per cent. Ambos Camarines and Sorsogon appear to have escaped this typhoon and no damage was reported.

Leyte and Samar.—The principal abacá districts in these two islands are the northern and northwestern parts of Samar and the northeastern and southern parts of Leyte. As in southern Luzon, so in Leyte and Samar, the damage caused by the drought of 1912 affected the lates on the lowlands and along the coast more than those lying farther back along the bases of the mountains. The shortage in the production of abacá from these two islands as a result of the drought in question is less than that in southern Luzon, probably not exceeding 20 per cent, for the following reasons: First, a larger proportion of lates than in southern Luzon are located near or along the bases of the mountains, where occasional showers of rain were not infrequent even during the worst period of drought; and, second, it appeared that the drought in the former provinces was of less severity and duration than in the latter ones.

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[1] Reproduced from a special report by the writer to the Director of Agriculture, dated October 14, 1912.

As to the two typhoons of 1912 and the May typhoon of 1913, both Leyte and Samar were less fortunate than the southern Luzon provinces. The October typhoon hit southern Leyte, the November one hit southern Samar and northern Leyte, and the May one of this year hit both southern Samar and Leyte. Leyte, therefore, suffered from these typhoons considerably more than Samar. As a result of these typhoons, therefore, the shortage in production of abacá during the fiscal year 1914 may be estimated at about 35 per cent in Leyte and about 20 per cent in Samar.

Other provinces.—Of the remaining provinces, Moro, Misamis, and Surigao are important in so far as the abacá crop is concerned. The drought occurred in all of them, but the degree of its severity and its duration varied, some being hit more severely than others. With the exception of Surigao, Bohol, Capiz, and Mindoro, they all escaped the typhoons which have occurred since last year's drought. The shortage in production as a result of both drought and typhoons cannot be estimated at more than 25 to 30 per cent.

SUMMARY.

In predicting the general production for the whole Islands during the fiscal years 1913 and 1914, we must not overlook three factors which have an important bearing on the question: First, the effect of the shortage in production in any one province on the total production; second, the beginning and duration of the period of time during which a certain shortage takes effect; and, third, the influence of such shortages in certain provinces on the production in other provinces which were not affected to any serious extent by either the drought or typhoons. Another factor which also appears to bear on the subject is a consideration of the period which elapsed between the drought and the typhoon or typhoons in any of the provinces affected by both. In certain instances, as Albay, the typhoon occurred almost one year after the drought, during which time a large number of the plantations had recovered to a more or less extent from the effects of the latter, thus rendering it incorrect to estimate the total shortage by adding the two shortages caused by both drought and typhoon. From the estimates given in this paper it would appear that a shortage of about 35 per cent in the total production for the Islands can reasonably be expected to occur, taking effect during January, 1913, and extending to May or June, 1914. This estimate, however, may possibly be reduced, owing to the fact that a large number of plantations which had been almost entirely neglected before the recent considerable rise in the price of abacá are now being harvested to their limit, if not beyond.

Summing up the whole situation as it now stands, and taking into consideration every factor which tends to increase or lessen the effects of the drought and typhoons of 1912, it is the opinion of the writer that the production of abacá may be safely estimated at not less than 145,000 metric tons for the fiscal year 1913, or about 10 per cent less than in 1912. The production during the fiscal year 1914 will be considerably less, probably not exceeding 110,000 metric tons, distributed among the provinces as follows:[1] Albay, about 29,000 tons, or 40 per cent less than in 1912; Ambos Camarines, about 14,245 tons, or 30 per cent less; Sorsogon, about 14,125 tons, or 30 per cent less; Leyte, about 13,750 tons, or 40 per cent less; Samar, about 9,370 tons, or 30 per cent less; Moro, about 6,620 tons, or 25 per cent less; Misamis, about 5,770 tons, or 25 per cent less; Surigao, about 2,637 tons, or 30 per cent less; and all other provinces, about 10,100 tons, or 30 per cent less; thus making a total of 110,617 tons, or a shortage of 48,856 tons (about 30 per cent) over fiscal year 1912.

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[1] Compare with production by provinces during fiscal year 1912, page 324.

RECENT PROGRESS IN HORTICULTURAL WORK AT THE SINGALONG EXPERIMENT STATION.

By O. W. Barrett, *Chief, Division of Horticulture.*

During the past six months the lines of horticultural work at the Singalong experiment station have been multiplied and broadened to a very great extent. The changes which have been necessary for the due progress of this branch of work of the division of horticulture have entailed but comparatively little extra expense in the line of labor, though they have necessarily required a large part of the time of the assistant horticulturist, Mr. H. H. Boyle; an agricultural inspector was detailed for a few weeks to help Mr. Boyle with the records; and from 6 to 8 laborers under 1 foreman have been employed. The broadening of the work is a noticeable feature and consists largely in the trying out of new varieties of vegetables and ornamentals for future distribution by the seed-distribution office of this division.

Soon after it became necessary to take up the new lines of work at the station, it was clearly evident that a proper fence should be constructed around the main propagation ground (something less than 1 hectare) ; the absence of such a fence heretofore had been responsible for considerable damage by stray dogs, pigs, and carabaos. Four hundred and twenty-five meters of woven wire fencing (1.42 meters high) with reënforced concrete posts has now been constructed.

A small addition to the old half-shade propagating shed was made to accommodate the extra number of seed flats which now number 340.

This new policy of experimental as well as propagation work necessitated the transfer to Lamao of a considerable number of fruit trees, shrubs, and plants; practically all of the old citrus trees which had become more or less diseased and infested with scale insects were taken up and set out in the unfenced portion of the grounds. A central roadway was laid out from the propagating sheds to San Andres Street. Next, the slightly raised beds were laid off at right angles to this main avenue. A section was reserved for the wholesale propagation of such vegetables and ornamentals as are considered suitable for distribution (this is already becoming crowded). Another section was reserved for bananas, mulberries, etc., and the main portion was thrown open to the series of vegetable tests, and herein have been tried out such new varieties as could reasonably be expected to withstand the Philippine climate.

The old list of vegetables carried by the seed-distribution office comprised some 20 varieties of standard temperate vegetables, exclusive of beans, maize, and forage crops. It was highly desirable that this list should be doubled or even trebled, but at the same time it was realized that no variety should be distributed, especially to Filipino planters, until it had given indications of its adaptability to our local conditions. Accordingly, small quantities of seeds of many varieties of the ordinary easily grown vegetables offered by American, Australian, and European seed firms were obtained. In some cases only sufficient seed for the test at Singalong, costing only a few centavos per variety, was obtained; in other cases enough for testing at several experiment stations was secured. In round numbers, about 1,000 varieties of vegetables have been tested during the past six months, and of these about 200 have been "passed" as worthy of introduction. So far as possible simultaneous plantings of varieties of radish, for instance, were made in order to compare the general quality of the seeds of one dealer with those of another, and at the same time ascertain the comparative value of the varieties in a class with each other.

Records of planting, germination, productiveness, date of maturity, and resistance to insect pests, etc., have been carefully kept in every case. Moreover, in special cases where striking results have been obtained photographs have been taken showing on the same plate, when possible, two, three, or four varieties of vegetables planted on the same date, thus giving a very facile means of quick comparison. In spite of the fact that these tests were carried on during the middle and latter part of the dry season and with due regard to the economizing of water, comparatively few of the varieties have failed outright through dry-weather conditions. It has been practically impossible, however, to give a proper test to such groups of vegetables as cabbages, lettuce, turnips, etc., that require more shade or at least cloudy weather and a lower temperature for the greatest success. By the same token, great numbers of leaf-infesting insects, which are always more abundant during the dry season on cucurbits (such as squash, cucumber, melons, etc.), have in a large measure checked or prohibited tests of this group of plants. Some 150 varieties of beans have been given a preliminary test at this station and most of these have been tried out also at the Lamao experiment station in Bataan, while a considerable number have been grown at the Iloilo demonstration station and at Trinidad gardens near Baguio, thereby giving a check on the results at the main station.

The soil of Singalong has been decidedly unsuited to high-class olericulture; but by means of mulching the young plants with rice straw and by using a considerable amount of stable manure and lumbang cake and a small quantity of chemical fertilizers, the poorness of the soil itself has been in a measure overcome, or rather offset, by the artificial stimulants.

It is worthy of note that during the past season practically no damage has resulted from the concentration of soil salts on the surface, although in the prolonged dry season of 1912 considerable trouble resulted from this cause.

In connection with the vegetable tests, which did not occupy more than two-thirds of the fenced area, it was found quite expedient and advisable to try out at the same time a good number of ornamentals. Special attention has been given to cannas, dahlias, gladioli, and miscellaneous pot and bedding bulbs and plants. While the propagating nurseries at Cementerio del Norte had already introduced a splendid lot of decorative shrubs and trees, at the beginning of these tests at Singalong it was scarcely possible to find more than 3 varieties of cannas, for instance, in the Manila gardens, although there is probably no more hardy a group of plants of first-class value for decoration than these. Practically no dahlias were in evidence; and, so far as we know, no gladioli. Of Crinums and Caladiums there were a very few hardy sorts, but none of the especially fine varieties which are practically as easy of cultivation as the old sorts. There are now in evidence at Singalong upwards of 150 varieties of cannas, most of which are beginning to flower; some 200 varieties of dahlias, about one-half of which have proven worthy of introduction; and about 125 varieties of gladioli, besides some 75 sorts of ornamental foliage and flowering bulbs.

It was clearly evident at the beginning of these tests that many of the introduced temperate sorts of dahlias, for instance, were suffering severely from the climatic conditions, and hence the interesting experiment of raising seedlings from well-recognized strains has been made with highly satisfactory results. Although not over 5 per cent of the seedlings were expected to give flowers worthy of propagation, it was found that fully 20 per cent of the planted-out seedlings have given flowers worthy of a name. Furthermore, these seedlings, being born and bred, so to speak, in the Philippines, are evidently more at home under tropical conditions than the plants from the imported roots; in fact, some of the new seedlings which are now beginning to show character have outstripped all but the very best of the imported temperate sorts in point of luxuriance and "hardiness" of foliage. About 30 varieties have been selected thus far for propagation and have been named for the several experiment stations of the Bureau of Agriculture and for the provinces. Incidentally, it happens that the new "decorative" type dahlias, "Singalong" and "Rizal," are unsurpassed by any of the imported sorts and will compare very favorably with the best dahlia varieties of the world. Some difficulty is expected with the propagation of these plants during the rainy season; but by carrying them through as cuttings in raised beds, in pots, and in case of emergency in the new greenhouse which is soon to be constructed from special funds appropriated for the permanent buildings at Singalong, it is hoped that most of the varieties will come through safely; the tubers will be "dried off" and held over in the storehouse until about November, 1913.

Distribution of all the first-class ornamental varieties which have withstood these tests will be made as soon as possible, preference being given first to Government institutions, such as hospitals, demonstration stations, the larger schools, etc., after which provincial governors and municipal presidents will be presented with collections.

Incidentally, several thousand fruit-tree seedlings have been raised and sent out to the fruit station at Lamao; this in itself, considered merely as routine work, has been a "large order."

Another interesting feature which has developed in the past six weeks is an orchid shed. The Bureau had been carrying for some time a considerable collection of orchid plants either presented to it by individuals outside of the Bureau staff or collected by its various officials in different sections of the Archipelago, and to give these plants, some of which were decidedly valuable, a "square deal" the erection of a modest and very cheap temporary "half-shade" shelter became necessary. Some 250 fine plants are now establishing, or "settling," themselves.

Other remarkable points of progress in the horticultural work are:

The successful rooting of bamboo cuttings, a process which has hitherto been considered exceedingly difficult if not, even under greenhouse conditions, practically impossible.

The forced feeding of Amaryllis offsets; a very valuable collection of these immense, beautiful flowers was presented some months since by the United States Department of Agriculture, and although the propagation of Amaryllis bulbs is considered so difficult that "flowering-size" bulbs retail at from ₱3 to ₱5 each in the United States and Europe, a special method of treatment has been hit upon by Mr. Boyle whereby not only the mother bulbs are fully recuperated after the great strain upon their vitality at the flowering season, but also the daughter bulbs (which were very small and weak upon receipt) have now been "fed up" on a special diet until it is believed they will be ready for distribution within a few months; from the original 45 mature bulbs received from Washington, D. C., fully 500 young bulbs will be ready for distribution within a few months and about 1,000 of a smaller size will be ready next year if they can be kept in as vigorous a condition as at present; and beyond this, hybrid seedlings are now being raised from a "cross" made by the writer between a near-white and dark-red pair of plants.

The saving of a rare lot of grafted India mango plants which arrived in Manila in a dead or dying condition; although there is thus far no suitable greenhouse for keeping sick plants in a saturated atmosphere, an improvised moisture chamber was constructed about this valuable collection and nearly all of the plants have been kept alive, while most of them are now throwing out new "flushes."

The most important collections of plants now in various stages of propagation at Singalong are:

A splendid collection of mulberries gathered from the far corners of the earth; many of the new varieties, particularly those presented by Mr. P. J. Wester, horticulturist of the Bureau, from his own place in Florida, have shown a very marked superiority over the old variety which has hitherto been propagated at and distributed wholesale from the Lamao experiment station.

A very large collection of bananas and plantains has been "started" either from roots or seeds; at present there are nearly 200 numbers (probably over 100 distinct varieties) of this class of plants in evidence at Singalong—35 numbers having been sent on to the permanent testing grounds at the Alabang stock farm, where it is hoped the largest and best collection of Musas in the world will soon be on exhibition.

A large collection of introduced and native yams (*Dioscorea* spp.)

A large collection of South American fruits and economic plants, seeds of which have been recently presented by Government stations in Argentina, Paraguay, Chile, and Brazil.

A collection of home-grown Coleus, numbering probably 100 varieties, which have been raised at practically no expense; the cream of the lot will go far toward helping out the deplorable shortage of good bedding plants for the "Manila beautiful" work.

In short, this station has probably turned out more "results," and accomplished the same more economically and more quickly, than any other institution of its size in the world in the same period of time.

THE ITALIAN BEES AT ALABANG, RIZAL.

By C. H. SCHULTZ, *Veterinarian, Alabang Research Laboratory, Rizal.*

During the last days of November, 1912, two hives of imported Italian bees were sent from Singalong, Manila, to Mr. Thomas L. Bean, at Alabang, Rizal. In December they were placed under the care of the writer.

In a grove of ipel-ipel trees (*Lucæna glauca*) near the laboratory a shed was prepared with a level cement floor surrounded by a gutter to keep ants away; over it a good iron roof of ample proportions gives protection from rain and sun. The hives face north and are exposed to the sun only during the early morning hours.

The bee boxes, ordinary rectangular frame hives, hold 10 frames, each 4.32 decimeters ($17\frac{1}{8}$ inches) long, 2.03 decimeters (8 inches) deep (inside measurements), and 3.50 centimeters ($1\frac{3}{8}$ inches) wide; they are covered by flat boards with cleats; no supers are used, the number of bees being too small. This type of hive is in common use on bee ranches in California and Oregon.

After the bees had become accustomed to their new location the colonies were examined. A nicely colored, large Italian queen bee, three frames of worker brood, and three entire frames of drone combs were found in one hive. The large number of drones at once indicated that the queen was old and scarcely able to keep up a thrifty swarm. The colony was well supplied with honey and bee bread, and the combs were old but straight.

In the second hive no queen was found, only worker brood and a great number of capped drone cells; worker bees and drones were numerous. Abundant honey and beebread was stored in good straight combs; most of the brood combs were dark and showed that they had been in use several seasons. The last drones matured December 2, so that the last eggs must have been deposited about November 10; the colony had evidently been without a queen since then.

The bees in the first hive were nicely colored; drones and queen had the appearance of pure-bred Italian bees. The bees in the second hive were darker, the drones almost black, probably from a queen of mixed breeding. Both colonies were gentle and permitted handling without becoming vicious—a very desirable characteristic.

The amount of honey gathered and stored between December 15 and January 10 was remarkable, when the small number of field bees is taken into consideration. Pollen was continually being brought in, so that beebread is abundant.

When the nights became cooler, the bees left the hive late in the morning. The honey flow ceased about the 12th day of January. The workers then summarily disposed of the drones, so that the number of bees was suddenly greatly reduced. The temperature in the brood chambers was found to be as low as 35.4° C. To remedy this serious condition, bee space over the bottom boards was reduced to 95 millimeters ($\frac{3}{8}$ inch); oil cloth was placed over the frames and the entrances were contracted to 7.6 centimeters or 1.01 decimeters (3 or 4 inches). This increased the temperature in the hives to a point which is favorable for the rearing of brood.

Although some days have been hot and sultry, the bees have never been uncomfortable; the work of caring for the young is carried on with greater regularity and the field force flies out earlier.

The temperatures in our locality are fairly constant and not subject to great sudden changes; careful consideration of the local conditions and the behavior of the swarms will soon demonstrate the type of hive that should be adopted.

At Alabang strong easterly winds blow across the lake almost daily during several months, which is a drawback, as it prevents the bees from going out regularly. They work best in the early morning hours and rest during the middle of the day, often resuming their flights late in the afternoon.

The honey the busy workers brought in is of a light amber color, nicely flavored, and of very good quality. Attempts made to locate plants that were especially productive of honey and pollen have, so far, not been successful. Artificial feeding will, it appears, never be required, if the beekeeper is careful in the management of his swarms.

The colonies are free from parasites. At one time red and white ants gained entrance to one hive; regulating the water level in the gutter soon stopped this annoyance. Some bees were caught by birds, some of the young queens being doubtless lost in this manner, a common complaint on all bee ranches.

The Apiary at Alabang, Rizal.

The problem arising when the Ligurian bees were placed in the writer's hands was exceedingly simple, but the solution proved difficult. It was necessary to raise young queens and mate them before the drones were destroyed or the only remaining queen was superseded by her workers. If this could be accomplished, the Italians were saved; if not, these nicely colored, gentle honey gatherers were doomed.

On December 4, the queenless colony was given two frames containing young brood and eggs; five queen cells were accepted, and from these four queens were raised, one of which was not perfectly developed. Two queens were caged. The young queen was successfully introduced (by Pond-Simmin's method) on December 22. Although drones were still flying in great numbers from this hive and the young queen was observed to fly out several times, it was not until January 21 that she began to deposit eggs.

Why twenty-five days should be required before the young queen began her duties in the hive cannot be explained.

A nucleus hive had been started on January 3. Although young queens were introduced and readily accepted on three different occasions, not one became a fertile mother. One queen was lost while flying; another remained in the hive for thirty-five days, made several flights when drones were present, but was never mated and never deposited eggs. It should be remembered that in temperate climates the drones are usually killed during the months of August and September, while here they were driven out during January. They were tolerated because their services were needed.

The number of field bees decreased in an alarming manner during January and February, because the old queen laid but few eggs. This decrease of the field forces required careful handling of the hives. The weaker hives were placed on the stands of the strongest hive every third day, so that the returning bees would supply the colonies in rotation. A bee bringing home a load can usually enter any hive, especially a hive that is in need of workers.

During this period of great scarcity of workers thermometers were placed over the brood frames and the small colonies helped along by carefully supervising every minute detail. For three weeks the situation was critical. In the midddle of February the apiary received the first recruits from the young queen.

To rear a queen in December and have her go out on a fruitful mating flight during January is a performance that a beekeeper in a temperate climate will scarcely believe. Nevertheless, it did occur and saved the bees.

The young queen is a good producer and lays eggs in compact masses; her progeny is nicely colored, of good size, and very tractable. Her hive, perhaps the first colony of Italian bees raised in the Islands, is at present in first-class condition and a welcome addition to the apiary.

Since then the number of workers has steadily increased. The young queen may not lay drone eggs until next fall, in which case it will be impossible to mate more queens. The old queen will lay drone eggs; but her workers realized that she should be replaced and they tried to supersede her. In order to protect this valuable mother bee, she was caged and all emergency queen cells that were started during her absence were promptly destroyed. Only when spring activity in the hive could be noted was the queen again introduced. Thirty seconds after she walked down the combs, a peculiar "hum" from the entire colony could be heard; she was recognized and was gladly accepted. Her hive was then stimulated by judicious feeding; new foundation was placed in the midddle frames and when egg laying was again under way, a drone comb previously cleaned out and warmed up in the other hive was put in place between the newly used brood frames.

After a few days eggs were found in this drone comb, and the first males of the season appeared on April 10.

Since the date could be foretold, queen cells were started at the proper time, so that to-day the two new hives have drones, young queens, and a liberal amount of field bees—a very good start so early in the season. The young queen can furnish brood for the two nucleus hives, and by careful handling the old queen will again produce fertile eggs for a limited period and drone eggs in greater numbers. These pure-bred drones will fertilize the young queens and, climatic conditions being favorable, the number of hives can be increased. It will be necessary to look carefully after all the details, or the workers will supersede the old queen so valuable for propagating purposes.

At present the apiary contains the following: One hive with the imported Italian queen; 1 hive with a very prolific young queen; 2 nucleus hives with virgin queens and drones and workers in abundance.

All these hives are in a thrifty condition. The imported queen will be retained as long as possible. Young queens can be raised without difficulty. They are kept on hand in cages ready for emergencies.

The question of the propagation of Italian bees in the Philippine Islands has, therefore, been answered in the affirmative. It must now be ascertained whether an apiary can be made a commercial success or not. Locations and conditions appear to be favorable, and the introduction of this industry will materially add to the contentment and prosperity of the population.

It is to be hoped that further experiments on a larger scale will show as desirable results as the first attempts at apiculture at Alabang.

THE FINANCIAL LOSS OCCASIONED BY HARVESTING UNRIPE SUGAR CANE.[1]

By D. S. PRATT and L. W. THURLOW.
(From the Division of Organic Chemistry, Bureau of Science, Manila, P. I.)

The composition of the juice found in sugar cane (*Saccharum officinarum*) undergoes a progressive change as the plant matures, attaining a maximum sucrose content between ten and thirteen months after planting. The purity of the juice, or proportion of cane sugar to total solids, at this period of growth is greater than at any other stage of development. The great importance of employing juice of high purity is so well understood by all sugar manufacturers employing modern centrifugal mills that further comment would be superfluous were it not for the fact that practically all Philippine sugar is still made in mills not possessing these features and controlled by *hacenderos* [2] who have not appreciated the direct relation existing between purity of original juice and quality of final product. It is for the benefit of such planters that this paper is written.

When cane juice is boiled in open kettles, and the massecuite dried without the use of centrifugal machines, the polarization of the resulting sugar closely approximates that of the original juice, but is never higher. It is thus impossible for the planter to make high-grade sugar when he crushes his cane before it has reached at least approximate maturity. Ignoring this fundamental fact has yearly resulted in heavy loss to many plantations. It cannot be denied that circumstances often arise over which the *hacendero* has no control and that make early crushing unavoidable. A field attacked by locusts or devastated by wind and flood requires immediate harvesting to avoid total loss of the crop. However, the proportion of such cases is relatively small compared to those where further time might be allowed for the cane to mature.

A brief discussion of the changes taking place in sugar-cane juice during the process of ripening and subsequent maturity may not be out of place. The young stalks contain, besides cane sugar, a greater or less amount of dextrose and levulose. These sugars constitute what is called invert sugar and are responsible for most of the troubles experienced by sugar boilers. Their presence prevents the cane sugar, or sucrose, from crystallizing, and reduces the polarization of the resulting product. The juice from cane containing high percentages of these products shows a low purity upon analysis, and is not suitable for manufacturing purposes. Levulose disappears as the cane matures, and ripe stalks contain little or none of this sugar. Dextrose is a normal constituent of all cane, although present in gradually decreasing amount in ripening stalks. Sound ripe plants contain from 0.4 to 1.5 per cent of dextrose. Further growth after maturity results in causing an inversion of sucrose with the formation of more dextrose and levulose. There is, therefore, a definite period when sugar cane should be crushed to secure the highest purity juice and maximum profit from the sugar.

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[1] Press Bulletin No. 15 of the Bureau of Science, Manila, released May 30, 1913.

[2] Planters.

Many considerations, beside unavoidable natural exigencies, have led *hacenderos* in the Philippines to start crushing their cane before it has reached the optimum condition of perfect maturity. In many cases this is the result of insufficient milling or harvesting facilities. When it is impossible to handle an entire crop within the period between ripening and subsequent deterioration, it is customary to start crushing green cane, gradually working into mature fields, and completing the season with overripe material. In this manner at least a portion of the crop is obtained in mature condition, and with good judgment none of it need be excessively green or overripe. If it be impossible to increase the equipment, this is doubtless the lesser of two evils. It happens frequently that the object in view is completely defeated, and the entire crop is crushed before any part of it reaches maturity. In such an event the unfortunate planter cannot possibly realize the full benefit from his cane, although the resulting loss might have been avoided had he delayed crushing until the proper time. Chemical analysis could have predicted the failure, and information on the subject would have avoided the mistake. Errors of this type are frequent when the season is two or three months late, as was the case this year, and are not always caused by ignorance of the condition of the cane. The great importance of planting at the proper season is recognized by all *hacenderos.* For this reason they are unwilling to suspend crushing while the cane matures, fearing that planting for the following year may thereby be unduly delayed. Furthermore, the labor question offers additional difficulties. It is not easy to hold men even during the milling season, and were operations suspended it would be necessary to pay full wages to insure sufficient assistance when crushing was resumed. Without definite information on the subject, the planter naturally fears that delays may prove not only expensive, but fatal to his future crop. Moreover, such a procedure would exceed the experience of the native *maestro,* or chief sugar boiler, who would be very certain of dire results.

All of these difficulties are more apparent than real. It is neither necessary to postpone planting because the cane is unripe at a season when custom has decreed that it should be crushed, nor is it essential that this green cane be harvested at once.

Long usage in the Philippines has resulted in planting merely the tops of harvested cane for points, although the nature of the plant is such that a much larger portion may be employed, and is so used in nearly all cane-producing countries. The stalk is naturally divided into joints, each containing a bud or eye capable of producing future canes. Each bud is surrounded by several rows of translucent spots that develop roots when the cane remains in contact with moist earth for some time. Thus, short pieces of stalk including these reproductive areas may be used as points. The lower portion of the cane is usually too dry for this purpose, but the upper two-thirds may be divided into about 10 sections. These pieces should be soaked a short time before being planted, and will then sprout readily. The plants used for points should be carefully chosen from the least mature cane, discarding dead and dry stalks. Fallow land is always available for receiving the points so obtained, and planting may proceed without interfering with the remainder of the maturing cane. This departure from the customary practice of harvesting and planting has not been commonly tried in the Islands, but where it has been followed the results have been most satisfactory. It possesses the great advantage of utilizing many of the laborers in cutting points, preparing land, and planting the crop for the ensuing year. Thus a delay in crushing will not necessitate idleness on the part of all the laborers, nor will it postpone planting beyond the proper season. This removes the two objections most frequently raised against postponing crushing until the cane has matured.

The benefits derived from following the above outlined scheme may be very great, and in extreme cases would often turn an actual financial loss into a considerable profit. Five examples illustrating as many variations in handling a field of cane may serve to make our contentions more clear, and at the same time show the different returns resulting from crushing the cane at various times. The crop under discussion would amount to 2,000 tons of mature cane. The *hacendero* possessed an ordinary mill, capable of producing 100 piculs of sugar per day, and employed 125 laborers during the crushing season. Expenses have been calculated on the basis of ₱5.60 per ton of cane, or ₱3.50 per picul of sugar.

Case I.—The cane was thoroughly ripe and at its highest purity when crushed. No. 1 sugar polarizing above 89 was produced, and sold for ₱7 per picul. This represents a profit of ₱11,200, or the maximum amount possible under the conditions applying to all these examples.

Case II.—The cane was not mature, and consequently weighed about 5 per cent less, or 1,900 tons. The purity was only 76 as compared to 89 in the first case, and the extraction averaged only 6.[1] The entire crop was harvested before any portion matured, and consequently all the sugar obtained was "corriente," polarizing under 76 and selling for ₱2.50 per picul. The cost of harvesting and milling was practically the same as in the preceding case, but the result was a loss of ₱6,080.

Case III.—The cane was identical with that in the preceding case, but crushing was delayed for three weeks. The laborers remained idle during this time and received ₱1,050 in wages. The cane had not reached full maturity at the end of the three weeks, but showed a purity of 84 and weighed 1,950 tons. The extraction was 8.5, and the resulting sugar was No. 3, polarizing between 82 and 84.9. This sold for ₱5.50 per picul and netted a profit of ₱2,616.

Case IV.—The cane was identical with that in Case III, but was allowed to stand in the fields for six weeks instead of three. This resulted in a purity of 89 and extraction of 10. The cane was, therefore, fully ripe and comparable to that in Case I. The sugar produced was No. 1, polarizing above 87, and sold for ₱7 per picul. The profit of ₱9,100 is lower than that in Case I, due to ₱2,100 paid the laborers during the six weeks of idleness.

Case V.—Advantage was taken of the idle period for cutting and planting. The result was a profit equal to that realized in Case IV, but with the very great added advantage that the crop for the ensuing year was planted at the correct season and under the best conditions for growth and development.

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[1] Calculated from data given by Walker in "The Sugar Industry in the Island of Negros."

These cases are purely hypothetical, but are based upon laboratory experience and actual conditions frequently occurring in our sugar industry. The data from them are given in the following table:

Results of harvesting cane at different periods of maturity.

Case No.	Cane.			Sugar.				Receipts.	Expenditures.	Profit.	Loss.
	Tons.	Purity.	Extraction.	Tons.	Piculs.	Grade No.	Value per picul.				
1	2,000	89	10	200	3,200	1	₱7.00	₱22,400	₱11,200	₱11,200	
2	1,900	76	6	114	1,824	6	2.50	4,560	10,640	----------	₱6,080
3	1,950	84	8.5	165.8	2,652	3	5.50	14,586	10,920 [a]1,050		
									11,970	2,616	
4	2,000	89	10	200	3,200	1	7.00	22,400	11,200 [a]2,100		
									13,300	9,100	

[a] Labor.

The above data should convince planters of the intimate relationship existing between purity of juice and the success or failure of their undertaking. When they realize that the laboratories of the Bureau of Science are in a position to predict the grade of sugar which may be expected from a field of cane by a chemical analysis of carefully selected stalks, avoidable losses such as are illustrated in Case II will no longer be of common occurrence. It is not necessary to start crushing the cane to determine the purity of the juice. One-half dozen representative stalks from the field may be cut, carefully packed, and shipped to the Bureau of Science, either in Manila or in Iloilo. The sample should be packed in moist cloth whenever more than two days are required for transit. The quality of sugar that may be expected from cane corresponding to the samples may then be as accurately determined as if the mill had been started and a portion of the sugar actually produced. By having analyses of the cane made from time to time, the planter may follow the progress of development and start crushing with confidence in the final outcome.

AGRICULTURAL CONDITIONS IN THE SUBPROVINCE OF BENGUET.

By Austin M. Burton, *Agricultural Inspector.*

Benguet, a subprovince of the Mountain Province, is situated in the north-central part of Luzon and bounded on the north by Lepanto and Ifugao, on the east by Nueva Vizcaya, on the south by Pangasinan, and on the west by La Union Province. Benguet is probably best known as being the subprovince of which Baguio is the capital. The subprovince is largely mountainous in character, and as the elevation runs from near sea level to over 8,000 feet (2,438 meters) there is naturally a great variation in climate and natural vegetation. At an elevation of approximately 4,000 feet (1,219 meters) the pine belt commences. In the higher altitudes live oak and cedar are also found. The larger part of the tillable land is found in small valleys through the mountains. Some of the principal agricultural sections are Trinidad Valley, Pugo, Ambuklao, Kabayan, Tublay, Bokod, Bugias, Sablan, and Kabungan. The compiled reports of the different township secretaries show 9,795 hectares of tilled and 13,108 hectares of untilled land in the subprovince. Much of the land which cannot be tilled is utilized as range for live stock.

The climate of Benguet varies with the elevation, but taken as a whole is ideal. In Baguio, which represents a fair average for the subprovince, the days are seldom uncomfortably hot and the nights are cool enough to make the use of two or three blankets necessary. The best season is from November to March or April. From April to the end of June there are generally showers in the afternoons, although the mornings are bright and sunny. The rainy season usually extends from July to October, inclusive, and is characterized by heavy rainfall, although, even during these months, the mornings are often pleasant. The mean annual rainfall at Baguio is about 146 inches (3.71 meters).

The general agricultural conditions in the subprovince at the present time are decidedly favorable to good crops, as the last rainy season was not severe, nor has there as yet been enough dry weather to seriously affect vegetation. The transplanting of rice has been going on now (February 15) for about six weeks, and if conditions continue as favorable as at present a good yield may be expected. Corn will not be planted, except where irrigation is available, until the first rains start, probably in April. Considerable tobacco has been planted in the township of Pugo, where the bulk of Benguet tobacco is grown.

Last year there was raised in Benguet 8,627 cavans[1] of rice, none of which was exported; 79,038 cavans of corn, measured on the cob; and 350,000 kilos of tobacco. There are no cigars or cigarettes manufactured in the subprovince. Besides these crops there was a considerable amount of camotes raised which were consumed locally; also quite a lot of vegetables and produce of the Temperate Zone. These vegetables have been introduced by the Bureau of Agriculture, and their popularity and adaptability to Benguet conditions is shown by the considerable number of home gardens maintained by the Filipinos. A large part of the produce marketed in Baguio comes from these gardens.

Cattle raising is quite an important industry. Last year's census showed 12,254, cattle, 1,760 horses, 2,360 hogs, and 5,620 carabaos. The stock is remarkably free from infectious or contagious diseases. The principal danger in stock raising is from the severe typhoons which come during the rainy season. Deaths among live stock in 1912 amounted to 819 by slaughter or by accidental falls and 1 carabao died of rinderpest.

The Benguet Igorot is an industrious and thrifty individual, and as much of the field work is done by the women as by the men. In rice planting and harvesting a whole community will work together, going from one man's field to another until the work is completed. At the present time it is rather difficult to obtain Igorot labor on account of the large number of people working on the railroad, but under ordinary conditions there is no difficulty in obtaining good laborers at an average wage of ₱0.50 per day.

The agricultural machinery is the same as that used in other parts of the Islands—the carabao plow and harrow for preparing the land and the lusong (mortar) and al-ó (pestle) for cleaning the palay. The general custom is to pound out the palay as needed, as the rice keeps better as palay than as cleaned rice.

Camotes are grown for the most part in small patches on the hillsides where it is impossible to use animals. The sod is turned with a sharp stick for a spade, and all the subsequent work of planting, weeding, etc., is done by hand. Camotes form quite an important part of the diet of the Igorot and are their main support in times when the rice crop runs short. The American sweet-potato plants distributed from Trinidad garden are much appreciated by the Igorot, as they give a much larger crop of better quality than the native varieties and have, therefore, been planted quite extensively.

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[1] 1 cavan equals 75 liters.

The Igorots are adepts in irrigation work and keep their rice paddies covered with several inches of water during the preparation, planting, and a large part of the growing seasons. The System in Trinidad Valley is a fair example of their work. In this system the water is diverted from the gorge of the Balili, commonly called the Trinidad River, and runs in a small earth and stone ditch along the Trinidad Road to the rice paddies in the valley. The paddies are so laid out that the water runs from one to the other, all of them being kept constantly covered. A continuation of this same ditch supplies water to Trinidad garden.

Baguio is the distributing center and market place for the subprovince. The two principal roads running into Baguio are the Benguet and Naguilian Roads. The Bureau of Public Works automobiles carry passengers and freight from Camp 1, where they connect with the Manila Railroad Company's train. Much produce from the lowlands is brought in over the Naguilian Road. Construction on the Manila Railroad Company's line to Baguio is being pushed along rapidly, and Baguio will have a railroad within a year or so. There are also a number of trails running into Baguio which lead to practically all parts of the Mountain Province. The subprovince has 125 kilometers of road constructed of which 56 kilometers are first class, 47 kilometers second class, and 22 kilometers third class. There are 354 kilometers of trail.

CURRENT NOTES—JULY.

NOTES By O. W. BARRETT, Chief, Division of Horticulture.

THE COCONUT'S GREATEST RIVAL.

Though in some respects the humble peanut is one of the very severest rivals of the Philippine coconut in the world's oil markets, it is quite likely that after all is said and done there is more loose oil waiting to be handled in West African "palm nuts" than in any other entity. From Sierra Leone to Angola and from the seacoast back for 200 to 500 miles the country is simply overrun with the oil palm, and practically all that is lacking to upset the price of copra and to demoralize the coconut industry is the construction or rather opening up of more ways of communication and transportation routes from the hinterland to the Gulf of Guinea coast.

Knowing this fact, and with their long experience in the business, the great British syndicate of Lever Brothers, Limited, has recently acquired a concession on the upper Congo which is said to embrace nearly 5 million hectares (12 million acres). Were such a vast area of a fairly good stand of the oil palm to be managed along modern lines, it alone would sooner or later affect the price of Philippine copra and would practically drive smoky tapahan copra (utilizable for soap as is palm oil) out of the world's market.

COCONUT IMPORTATION INTO THE UNITED STATES.

Copra is sent into the United States in largely increasing quantities; according to the Daily Consular and Trade Reports of the United States Department of Commerce, the 1912 (fiscal) importations reached some 32,000 tons against less than 19,000 tons in 1911, and only 7,000 tons in 1908. It must be remembered, however, that the United States still imports vast quantities of coconuts in the shell from tropical America; in the last fiscal year some 4 million pesos worth of fresh nuts were brought in, or double the amount of ten years ago.

Last year the Philippine Islands furnished about 70 per cent of the supply of copra for the United States.

AUSTRIAN COCONUT BUTTER.

According to the American consul at Carlsbad the present output of coconut butter in Austria is approximately 300 tons per day; a few years ago the output was only about 50 tons per day. Although the price of this excellent and popular butter has increased from about ₱365 to ₱520 per ton, the factories can scarcely keep up with the demand.

COCOSE.

The French product sold under this name, manufactured from copra (probably with the addition of small quantities of other substances), is said to be rapidly gaining in popularity, especially among Mohammedan countries. Being assured that this product contains no trace of hog fat nor beef tallow, both Mohammedan and Hindu peoples can use it as a butter.

It would seem, however, that for the peoples of tropical countries wherein all butters are with difficulty kept from melting, a good coconut cooking oil would be in greater demand than a high-priced tinned butter like "Cocose," which now retails in tins for a little less than ₱1 per kilo.

ANOTHER NEW FOOD OIL.

Still another rival to Philippine copra has entered the field. In Madagascar and in both eastern and western tropical Africa rather large numbers of the baobab tree are found. From the seeds of this huge tree is obtained a fine yellow oil of pleasant odor, and, so far as known, free from any injurious effects when used as a food. Baobab oil, like that of the coconut, solidifies in part at normal temperatures, the liquid portion being almost pure oleic and the solid part a mixture of stearic and palmitic acids. It is proposed to use the hard portion in the manufacture of artificial butters and margarines and to put the liquid portion on the market as an olive-oil substitute.

However, the coconut planters need feel but little anxiety over the discovery of this new source of vegetable oil, since the tree is nowhere very abundant, could hardly be cultivated, and in the opinion of the writer, who was familiar with one or two species in central Mozambique for several years, the prolificness of trees, even those having a trunk 4 meters in diameter, is remarkably low; and though the oil content of the seed may be as high as 40 per cent, the seed content of the fruit (about half the size of the Philippine papaya) is comparatively small.

SOYA OIL.

According to the Daily Consular and Trade Reports the new process for the extraction of oil from soya beans is now a success. This process employs gasoline as a solvent, and in this way the cake or residue, known in Germany as "schrot," is free from the dangerous purgative substances which have hitherto practically prohibited its use as a cattle feed. With the old method of crushing and pressing, the proteid substances in the raw bean (which are the base of the bean "cheeses" so commonly used as food throughout the Orient) caused much trouble through the sticking of the "cake" to the press cloths.

PEANUTS.

The world's oil hunger is so great and is increasing so fast that the output of India and West Africa begins to assume almost incredible proportions. The peanut, being a very easy crop for even the most ignorant natives to handle, and moreover one which is a fairly good food seed, and one which can be stored well, it follows that transportation and demand are about all that is required to render this crop a very severe rival to copra.

Furthermore, the peanut in out-of-the-way places like tropical Africa is frequently used as a barter commodity, thus proving its well-established status as a "staple." The writer remembers an interesting case of this kind: In the hinterland of the State of Quelimane on the north side of the Zambezi River the Loamo tribe, having no means of procuring salt in their own territory, are accustomed to send carriers every few months down to the tribes near the mouth of the Zambezi to trade for this necessity; the carriers are obliged to travel through the worst lion-infested country in the world for several days, sleeping, of course, without protection and fully expecting to lose one or two members of each camp every night, and carrying a load of some 25 kilos of shelled peanuts sewed into bark bags, to receive only one handful of dirty salt per load at the end of the journey. That is, the peanuts, being the only commodity available for barter, were sold at probably about one-twentieth of their actual value, although they were staple and standard. In the West African colonies, too, the price paid to the natives producing the raw product is excessively low, and, moreover, cheap "trade goods" instead of cash are used in most cases.

It is interesting to note that even after the great recent increase in the copra shipments to Europe the amount of peanuts handled at the great oil port of Marseille is nearly twice that of copra. This ratio, however, does not hold true for English and German ports.

The Coromandel coast of India (the west side of the Bay of Bengal) is now shipping to Marseille something like 250,000 tons of peanuts per annum, which should yield in the presses about 125 million liters (say, a million barrels) of oil. Unfortunately, the careless methods of the India natives in preparing their raw product result in more than one-half of the oil being rancid and unfit for food. It is a deplorable fact that practically no peanuts are produced to-day, commercially speaking, in the Philippine Islands. Many thousand tons could be grown without interfering with the other crops, and this would give very much needed funds to a large number of "small planters" throughout the Archipelago.

CITRUS CULTURE IN THE UNITED STATES.

The present crop of oranges in Florida is said to be excellent and will, of course, command unusually high prices on account of the recent disastrous freeze in California. At present in Florida there is said to be about 200 million pesos invested in the citrus industry. The annual output is valued at something over 30 million pesos, and it is expected that this "tidy sum" will increase within a very few years to something like 100 million pesos per annum.

Before the recent terrible disaster to the citrus groves in southern California that State was producing 40 per cent of the world's commercial oranges and 75 per cent of the total orange crop of the United States. California, however, produces only one-half of the world's lemons, Italy supplying, of course, practically all of the remainder.

A NEW FRUIT EXTRACT.

From the Daily Consular and Trade Reports we learn that the Citrus Fruits Company, an American corporation of Boston, Mass., has established a factory in Palermo, Italy, for the manufacture of some new citrus-fruit products. It is reported that there has just been perfected a secret process which allows the manufacture of fruit essences in concentrated form; this will be of great use and, we believe, will soon become popular in confectionery as well as in soda-water flavors. The latter subject is of much greater importance than most people realize, and when we can have an evaporated orange, lime, lemon, and mandarin fruit paste or jelly, uncontaminated by "preservatives," a great advance will have been made. Now, if it is possible to make a flavoring paste from citrus fruits in Italy, why can we not in the Philippines put up similar articles from the pineapple, the mango, the lanson, the goyabano, the ates, the guava, and, better than all the rest, perhaps, the many excellent distinct-flavored bananas and plantains?

NOTES By P. J. WESTER, Horticulturist.

THE LATEST THEORY OF SEX DETERMINATION.

The determination of sex is a riddle that for ages has puzzled the minds of men, and numerous are the theories that have been advanced in an attempt to explain what factors determine the sex in the progeny, only to as frequently be abandoned as untenable in the light of experimentation; and it has long seemed and has been asserted by many that sex determination was a mystery held in trust by nature and one that was forever to remain unraveled. It now would appear that while it has continued to occupy the minds of many biologists, the problem has in reality already been solved for some years. This remarkable discovery, if it is true, will unquestionably mark a new epoch in animal as well as plant breeding and even in eugenics. In 1878 Prof. Theophilus Ciesielski, of Lemberg, Austria, as a result of continued experimentation begun in 1871, propounded the startling theory given here below.

From his work with dioecious plants, Ciesielski found that barely matured pollen produced a great proportion of male plants, while if he used thoroughly ripened, or "stale," pollen in fertilizing the female flowers, the progeny were nearly always females.

The original investigations by Ciesielski were conducted on *Cannabis sativa* and *Spinacia oleracea.* It is not necessary to go into the particulars of the experimental work which led to the discovery in question.

Those who are interested in the subject should consult the original article, which was published first in Latin and was later translated into English, in which form it appeared in "International Clinics" (Vol. III, 22d series, 1912), with a preface by Dr. S. W. Carruthers.

The experimental work with the two plant species mentioned was concluded in 1898, after Ciesielski had proved to his satisfaction that pollination with freshly shed pollen resulted in male plants while well-matured pollen produced female plants.

Having reached this result in plants, Ciesielski extended his investigations to animals, and tested his theory in numerous experiments with rabbits, dogs, horses, and cattle, an overwhelmingly large number of which served to verify the previous results. Finally, Ciesielski states that he has repeatedly recorded the application of the same law in the human species also.

To sum up: According to Ciesielski the sex of the progeny is governed by the age of the male reproductive cells at the time of fecundation, and that the law discovered by him applies to all living things, whether plants, animals, or man.

In plants this new theory will be of more or less academic interest, but in its relation to animals and man the result may be much more important and far-reaching—*if it endures the light of careful research.*

A NEW PRESERVE.

In connection with the article on roselle which appeared in the May, 1913, issue of the REVIEW our readers may be interested in knowing that before the end of the current year "roselle sauce" will be placed upon the market in large quantities for the first time.

The Luzon Pineapple Plantation Company, operating in Cabanatuan, Nueva Ecija, is the first concern to enter upon the manufacture of the new preserve upon a large scale. Organized in 1911, principally with the object of growing and canning pineapples, this company acquired 1,024 hectares of land in the locality mentioned, of which 40 hectares were brought under cultivation, and 16 hectares planted to pineapples last year. It is planned to plant 24 more hectares to pines during the present year. They now have under construction a canning factory with a capacity of 8,000 cases per month which will be ready for operation by September 1.

Last year the company grew roselle experimentally from seed supplied by the Bureau of Agriculture, and several of the leading officers of the firm were so favorably impressed by the possibilities of roselle that they decided to plant 8 hectares to this crop this year, the fruit of which will be manufactured into "roselle sauce." Such of our readers as may be interested in the handling of this new product should communicate with Mr. Leon C. Kellogg, manager, Luzon Pineapple Plantation Company, Cabanatuan, Nueva Ecija, P. I.

A TREATISE ON MANGO.

This is the name of a small but eminently practical little publication, written by Mr. P. C. De, and first published in 1897, a second revised edition, the one coming to our notice, having been issued in 1904.

The author touches lightly upon the history, botany, and geographical distribution of the mango, but discusses the practical features of mango cultivation exhaustively and lucidly from a modern orchardist's point of view that is refreshing when we consider the dearth of good literature on the subject. In fact, we suspect that even to-day, nine years after its issue, the author is greatly anticipating the Indian mango grower in his orchard management.

Two hundred thirty-nine mango varieties are enumerated, the majority of which are accompanied by more or less incomplete descriptions.

Altogether, the aforesaid publication (which may be obtained by addressing Mr. P. C. De, 28 Beadon Row, Calcutta, India, inclosing money for the equivalent of 1 rupee) is one of the very best ever issued on the subject, and one that an up-to-date mango grower can ill afford to be without.

THE RICE WATER WEEVIL IN THE UNITED STATES.

Frequently we are tempted to say that we have in the Philippines more than our just quota of insect pests and fungi that devour and devastate our crops. Still there are many evils, the absence of which we may note with satisfaction, for instance, the rice water weevil (*Lissorhoptrus simplex*), which is considered the most serious rice enemy in the southern United States. While in many places where it has appeared the injury to the rice is insignificant, a crop loss of 75 per cent resultant from this pest has been reported from some fields in Arkansas. In addition to rice as a food plant, the rice water weevil also feeds upon many indigenous species of wild rice, water lilies, bulrush, swale grass, spatterdock, etc., and this increases the difficulties of its control. The principal damage is caused by the larvæ which feed on the roots of the rice; some slight injury is done by the adults devouring the leaves. One generation of the insect in one season is the rule.

A "NEW" GUANO DEPOT.

One of the most recent countries to be exploited for guano is French Somaliland. The extensive guano deposits on the numerous small islands on the coast of the French and Italian possessions in the Red Sea have been known to exist for some time, but it is only recently that their excavation on any considerable scale has been begun. The guano is shipped to Europe through the port of Jibuti and is said to be of high quality.

PHILIPPINE MANGO EXPORTS.

To those countries where the annual fruit exports total millions of pesos, the Philippine export figure of ₱20,000 for mangos for the month of May does, of course, appear as an insignificant item; but it is large, nevertheless, when we consider that during the fiscal year ending June 30, 1911, the total fruit exports from the Philippines amounted to but ₱19,994, and that the average annual exports of mangos for the past few years have been only ₱6,000. It is one of the straws that indicate the advent of better days for fruit culture in the Philippines.

ERRATUM.

On page 252 of the May, 1913, English REVIEW, the second paragraph of the current note entitled "Olive-oil crop in the Mediterranean countries," by P. J. Wester, should have read as follows:

> The olive fly is related to the mango fruit-fly discussed by the writer in a previous issue of the REVIEW, and is also a relative of the Mediterranean fruit-fly, which has been so destructive to the orchard fruits in the region from which it takes its name, so destructive also in South Africa and Australia, and which, more recently, has become notorious through its invasion of Hawaii.

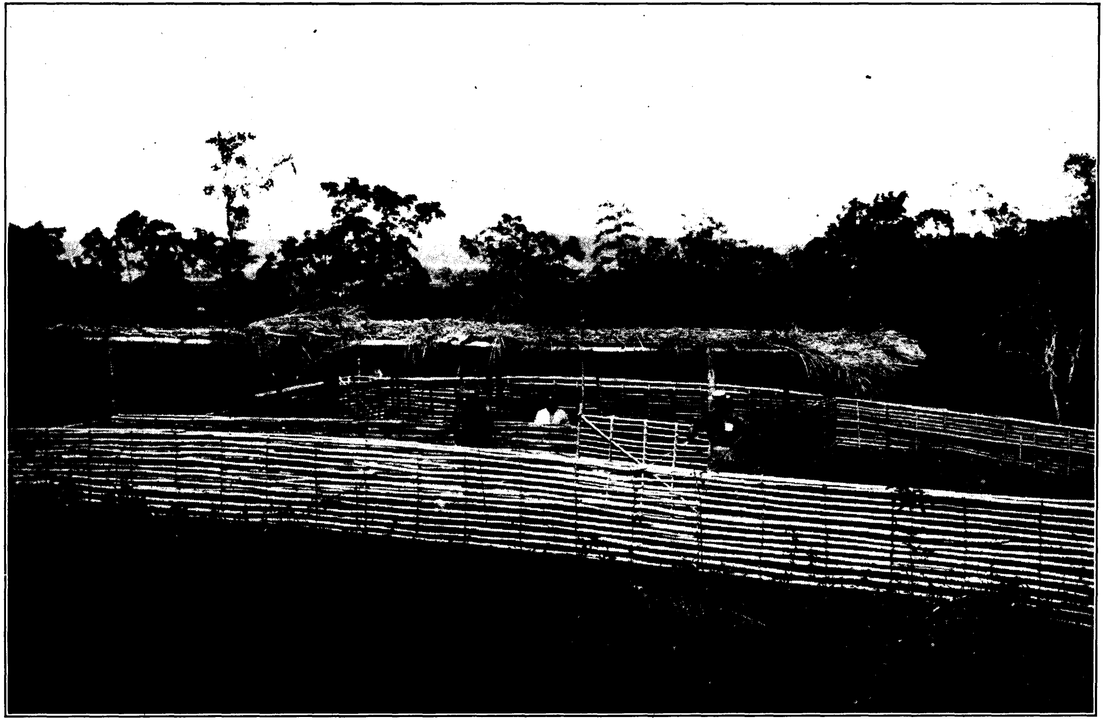
TEMPERATURE AND RAINFALL FOR AGRICULTURAL DISTRICTS IN THE PHILIPPINES.

By the DIRECTOR OF THE WEATHER BUREAU.

APRIL 1913.

[Temperature and total rainfall for twenty-four hours beginning at 6 a. m. each day.]

Date.	Abacá (Manila Hemp).				Sugar, Iloilo.		Rice, Tarlac.		Tobacco.			
	Albay.		Tacloban.						Aparri.		S. Fernando.	
	Temperature.	Rainfall.	Temperature.	Rainfall.	Temperature.	Rainfall.	Temperature.	Rainfall.	Temperature.	Rainfall.	Temperature.	Rainfall.
	°C.	mm.	°C.	mm.	°C.	mm.	°C.	mm.	°C.	mm.	°C.	mm.
1	27.7	0.3	27.9	------	27.1	------	29.6	------	26.7	------	28.8	------
2	26.7	------	27.1	------	27.4	1	28.2	------	26	------	27.8	------
3	27.6	18	26.9	0.5	26.6	------	29.2	------	25.7	------	27.4	------
4	26.7	.5	26.3	2.8	27	------	28.2	------	26.5	------	28.3	------
5	27.1	.5	26	.5	26.3	------	27.5	------	26.8	------	28.6	------
6	27.1	------	24.9	8.3	26.6	------	28.3	------	26.8	------	27.6	------
7	27.9	------	26.9	------	27.9	.5	28.9	------	26.7	------	27	------
8	27.2	------	26.6	------	27.4	------	29.9	------	26.8	------	27.4	------
9	27.9	.5	25.2	19.1	26.9	------	29.8	------	26.7	------	28.2	------
10	28.1	------	25.9	.5	26	3.3	29	------	26.6	------	29	------
11	27	5.5	24.7	72.9	27.4	------	30.2	------	26.6	------	27.9	------
12	26.1	31.5	26	34.6	27.1	39.7	28.6	------	26.4	------	28.2	------
13	26.2	12.5	25.8	11.7	26.9	------	29.6	------	27.2	------	28.8	------
14	26.2	22.1	25.6	20.8	26.6	------	30.5	52.8	27.6	------	28.2	------
15	25.4	25.2	26.5	4.3	25.2	11.1	28.2	44.4	27.2	------	28.8	------
16	26	.8	27.9	.5	26.7	17.5	28.8	11.4	27	------	28	------
17	28	------	27.2	.8	26.8	8.6	27.4	------	26.1	19.8	28.4	18.8
18	27.3	7.9	27.3	.5	26.6	------	27.7	2.3	24.8	29.7	27.2	4.1
19	27.1	3.8	26.9	------	28	------	27.5	1.3	25.3	1.3	25.7	------
20	28	------	26.2	8.6	28.1	5.3	27.4	------	26.5	.5	27.2	------
21	28.4	1.8	27	1.8	27.9	------	28.2	------	26.9	------	28.5	------
22	28.2	3.3	27.4	------	28.2	------	28.3	------	27.5	------	28.8	------
23	27.6	16.8	27.1	2.1	28	------	27.9	------	27.6	------	28.8	------
24	28.4	.5	27.6	2.3	28.1	------	27.2	------	27.4	------	28.4	------
25	28	5.1	27.4	1.3	28	------	28.9	------	27.5	------	28.3	1
26	28.2	4	27.2	.3	28.2	.8	28.8	------	27.2	------	28.2	------
27	28.1	3	26.8	10.1	28.2	1.3	29.2	------	26.9	------	28	------
28	27.1	18.4	26.8	5.1	27.8	.5	29.4	------	26.8	------	27.5	------
29	27.9	.3	27.4	.5	28.2	------	28.9	------	26.8	------	27.8	------
30	28.3	------	27.2	7.3	28.1	------	28.4	------	27.3	------	29.1	------



Corral for the isolation of animals sick with rinderpest. Scout guard, Bureau inspector, and caretaker.

VETERINARY NUMBER.

THE PHILIPPINE

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EDITORIAL.

THE PHILIPPINE VETERINARY PRACTICE ACT.

The regulation of the practice of veterinary medicine by legal restrictions limiting the treatment of diseases of domestic animals for pay to persons properly qualified by education is a matter of high humanitarian interest. Unqualified persons not merely fail to relieve suffering among animals, but by means of the brutal treatment inflicted frequently bring about worse injuries than the original diseased condition. The passage of Act No. 2245 by the Third Philippine Legislature, the text of which appears on page 362, is a matter of great importance. Its features compare favorably with the best of similar legislation elsewhere.

THE COLLEGE OF VETERINARY SCIENCE.

The popularity and success of the College of Veterinary Science, University of the Philippines, constitutes one of the brightest features of the progress of veterinary affairs in the Islands. Established three years ago with a curriculum of four years, the college was strengthened the next year by lengthening the course to one of five years of nine months each.

Happily, at the time of the foundation of the college there were men on the Board of Regents who appreciated the necessity for high and identical standards for veterinary and for medical education. Among them was Murray Bartlett, now president of the University of the Philippines, a fact that augurs well for the continuation of a policy of uplifting the veterinary profession by giving its recruits an education commensurate with the problems that it faces.

The Philippine Legislature has always displayed a liberal policy in dealing with educational matters, and the list of acts affecting the progress of the veterinary profession given by Drs. Palmer and Buencamino in their article on the college on page 368 embraces highly important legislation as affecting the future of the profession.

At present there are but two properly trained graduate Filipino veterinarians in the Islands, and to one of these, a joint author of the article in question, belongs the credit for conducting the clinic described in that article. During the first seven months of the existence of the clinic there were treated 510 cases of disease distributed among 457 animals. These figures for so short a period at the very inception of such a clinic are gratifying. They show a large amount of suffering among dumb animals relieved, and further give an indication of the need of Filipino veterinarians for general practice.

THE RINDERPEST CAMPAIGN DURING THE FISCAL YEAR ENDING JUNE 30, 1913.

The general policy of combating rinderpest by quarantine with the aid of the Philippine Scouts has been continued during the year. The progressive search of territory for rinderpest has involved work in Bulacan, Rizal, Laguna, Zambales, La Union, Ilocos Sur, and the subprovinces of Amburayan and Abra. Work of this character remains to be done in parts of Ilocos Sur, Abra, Ilocos Norte, Cagayan, and Isabela.

During the early part of the year the disease was apparently eradicated from the Provinces of Iloilo and Capiz. Minor outbreaks during the year were suppressed in Ambos Camarines, Antique, Bohol, Misamis, Leyte, Mountain Province, Surigao, and Tarlac.

Figures for the week ending June 28, 1913, show 6 provinces in which cases occurred; 8 provinces in which quarantine was in force, due to the discovery of cases within a month previous; and 23 municipalities known to be infected. Compared with the previous year this represents a gain of 3 provinces and 12 municipalities over the previous year. To this might be added 8 more provinces, not listed as infected at the beginning of the year, but in which rinderpest has been discovered and apparently suppressed during that period.

Of the 23 municipalities remaining infected at the end of the year, 11 are in Pampanga, 2 in Zambales, 1 in Pangasinan, 2 in La Union, 2 in Ilocos Norte, 3 in Cagayan, 1 in Isabela, and 1 in Ilocos Sur.

An encouraging feature is the apparent restriction of the area in which riderpest infection exists at present. During the year campaigns have been in progress in such widely separated islands as Mindanao, Leyte, Bohol, and Panay, besides the more extensive operations on Luzon. At present writing known infection is restricted to the north of Manila Bay. Territory in which the campaign is being conducted at present, or which must be covered in the future, contains a large percentage of the carabao and cattle of the Archipelago. The combined figures for cattle and carabao in Zambales, Pampanga, La Union, Ilocos Sur, Ilocos Norte, Cagayan, and Isabela amount to 405,208. This is approximately 32 per cent of the number of cattle and carabaos reported in the Islands on July 1, 1912.

C. B. No. 16.

THIRD PHILIPPINE LEGISLATURE,
Special Session of 1913.

[No. 2245.]

An Act to regulate the practice of veterinary medicine and surgery in the Philippine Islands.

By authority of the United States, be it enacted by the Philippine Legislature, that:

SECTION 1. The following terms used in this Act shall, for the purposes thereof, each have the meaning and signification herein stated:

(*a*) The "board" shall be the veterinary examining board herein created.

(*b*) "Veterinary medicine" means the science and practice of healing, curing, treating, and killing any and all animals, whether by and with the use of medicines, drugs, or surgery, or in any other manner, for fees, pay, hire, or compensation; slaughtering animals for food shall not be comprehended in the term "killing" within the meaning of this Act.

(*c*) "Veterinarian" means every person authorized to practice veterinary medicine as above defined.

(*d*) "Diploma" includes every certificate, authorization, or other document issued by a school, as defined in the next following subsection, in which any person is declared or stated to be or to have been found to be qualified or competent to practice veterinary science or medicine.

(*e*) "School" includes every school, college, university, or other institution of learning legally qualified to teach veterinary science and the practice of veterinary medicine and vested with power and authority to grant or confer the degree of doctor of veterinary surgery or any like degree, or to issue diplomas conferring such degree, or permitting, licensing, or otherwise authorizing persons to practice veterinary medicine.

(*f*) "Certificate" means the document which the board is authorized in this Act to issue or has issued to any person, giving or granting to such person the right to practice veterinary medicine in the Philippine Islands.

(*g*) "Applicant" means every candidate for admission to practice veterinary medicine and every person who has made application to be examined by the board.

SEC. 2. The Governor-General shall appoint three reputable veterinarians to be members of and to compose a body to be known as the veterinary examining board. The persons so appointed shall be citizens of the United States or of the Philippine Islands and residents of the Philippine Islands and shall each have been granted a diploma by some reputable school of veterinary medicine and shall have practiced or taught veterinary science or medicine for not less than three years.

SEC. 3. The three persons first appointed under section two of this Act shall hold office, respectively, one for one year, one for two years, and one for three years, as the Governor-General shall designate; but thereafter the term of office of each member shall be three years or until his successor has been appointed and has qualified. Any member whose term has expired may be reappointed.

SEC. 4. Vacancies occurring on the board shall be filled under like conditions for the unexpired terms as those under which original appointments are made.

SEC. 5. Any and all members of the board may by the Governor-General be removed for misconduct, incapacity, neglect of duty, or other just and sufficient cause.

SEC. 6. Every person appointed as a member of the board shall, before entering upon the discharge of the duties of his office, take and subscribe an oath or affirmation for the faithful performance of his duties.

SEC. 7. That member of the board whose term of office may at any time be shortest shall be the president of the board. The board shall elect one of its members as secretary and treasurer. It shall provide a seal. It shall meet not less frequently than once in each year for the purpose of examining all applicants who may at such time be desirous of undergoing an examination. Of meetings held for this purpose the board shall give notice by publication or announcement in at least two papers published in Manila for not less than four weeks prior to the date of such meetings.

SEC. 8. The board may hold such other meetings and at such times as it may determine to be necessary for the proper conduct of its business and for the like purpose and to the like end may adopt rules and methods of procedure and assign duties to its members.

SEC. 9. The board is empowered to require oral and written examination from applicants, to prescribe reasonable rules and regulations for the conduct of such examinations, and to refuse to permit applicants to take or to continue examinations for any violation of such rules. The examinations shall be prepared and designed to test and establish the knowledge and qualifications of applicants of and with regard to the following and such further subjects as the board may deem advisable or desirable:

Comparative anatomy, physiology, chemistry, veterinary surgery, obstetrics, pathology, diagnosis, therapeutics, practice, and materia medica.

SEC. 10. The board shall prepare questions in each of the subjects named in the last preceding section and in such other subjects, if any, which may have been added thereto, and shall cause a sufficient number of papers bearing such questions, and all other necessary papers, to be printed or otherwise prepared so that each applicant may be supplied; and all written or printed questions at any examination shall be alike and uniform for all applicants taking such examination.

SEC. 11. Every applicant for an examination, and every applicant for a certificate to practice veterinary medicine, shall submit verified statements or such other proof as the board may require that he is a person of good moral character, that he has studied and duly passed examination in at least the subjects specified in section nine of this Act, or holds a certificate or diploma from some recognized and reputable school of veterinary science. No person who has been convicted by a competent court of a crime involving immoral or dishonorable conduct shall be permitted to take an examination or shall be given or granted a certificate to practice veterinary medicine. The board may refuse to examine or grant a certificate to practice veterinary medicine, or revoke a certificate already issued, for serious and justified reasons, in which case the interested person shall be so informed and what he has to say in his defense heard, and an appeal shall lie to the Governor-General.

SEC. 12. Every person of good moral character not less than twenty-one years of age who is a resident of the Philippine Islands, and who by verified statements satisfies the board to that effect, shall upon application be admitted to take examination with a view of becoming a certified veterinarian, but not until he has paid to the secretary-treasurer of the board the sum of twenty-five pesos as a fee for such examination. No such fee shall be returned to any person unless he decides before he has begun the examination to retire or withdraw therefrom.

SEC. 13. The board is authorized to issue or to refuse to issue to any applicant after examination a certificate to practice veterinary medicine, according as such applicant has been found to possess or to fail of the necessary knowledge and qualifications.

SEC. 14. The board is further empowered to issue without prior examination a certificate to any person over twenty-one years of age who has heretofore taken and passed a civil service examination as a veterinarian for service in the Government of the Philippine Islands.

SEC. 15. It shall be the duty of the board to cause to be prepared and kept a permanent record in which all persons to whom certificates have been issued shall be registered, and in which such other information as to the board may seem desirable shall be noted or recorded.

SEC. 16. The secretary-treasurer of the board shall keep minutes of the meetings of the board, shall be the custodian of the oaths of office of the members, and of the seal, records, books and other property of the board, and shall collect and pay into the Treasury all fees and moneys so received, and account therefor to the Insular Auditor.

SEC. 17. Every certificate issued under the provisions of this Act shall be regarded as conferring authority on the person to whom the same was issued to practice veterinary medicine in any province, city, or municipality in these Islands subject to the provisions of section eighteen hereof, and this authority and the conditions prescribed in the next succeeding section shall be set forth on the face of such certificate.

SEC. 18. Nothing in this Act contained requiring the payment of a fee for a certificate to practice veterinary medicine shall exempt any person who practices veterinary medicine from the payment of the internal revenue occupation tax of twenty pesos as fixed and prescribed in paragraph numbered ten of section one hundred and forty-four of Act Numbered Eleven hundred and eighty-nine, entitled "The Internal Revenue Law of Nineteen hundred and four." The Collector of Internal Revenue shall from time to time report to the secretary of the board the name and address of every person to whom an internal revenue tax receipt has been issued for the practice of veterinary medicine.

SEC. 19. Upon proof satisfactory to the board that any certificate issued by it under this Act has been lost or destroyed it may issue a duplicate certificate to the person to whom the first certificate was issued, after payment of a fee of five pesos for such duplicate.

SEC. 20. Nothing in this Act shall apply to veterinarians employed in the United States military service while they remain in the employ of the Government of the United States.

SEC. 21. The members of the veterinary examining board herein provided for shall receive a fee of five pesos each for each person examined for registration as a veterinarian.

SEC. 22. The Director of Agriculture is hereby authorized, subject to existing provisions of law, to furnish the necessary books, forms, supplies, and equipment for the proper conduct of the business of the board and to provide a place for its meetings and examinations.

SEC. 23. All persons falling within one of the following classes shall upon conviction be punished for each offense by a fine of not less than twenty-five nor more than one thousand pesos, or imprisonment of not less than one month nor more than two years, or by both such fine and imprisonment in the discretion of the court:

(*a*) Every person who, claiming to have been authorized and empowered to practice veterinary medicine under laws or regulations in force prior to the passage of this Act, shall practice or attempt to practice veterinary medicine or hold himself out to be a veterinarian after three months have elapsed from the date of the promulgation of this Act without having obtained a certificate from the board under section fourteen of this Act;

(*b*) Every other person who practices or attempts to practice veterinary medicine after the passage of this Act without having first obtained a certificate under section thirteen or fourteen of this Act;

(*c*) Every person practicing or attempting to practice veterinary medicine under a false or assumed name or holding himself out under a false or assumed name to be a veterinarian, and every person in any way falsely and fraudulently impersonating any veterinarian to whom a certificate has been issued;

(*d*) Every person who sells a certificate or diploma, every person who lends or permits another to have or use a certificate or diploma with a false or fraudulent purpose or intent, or knowing or having cause or reason to know or believe that such certificate is intended to be used for a false or fraudulent purpose;

(*e*) Every person who buys a certificate or diploma, or borrows the same with a false or fraudulent intent or purpose, or steals the same or acquires the same in any false, fraudulent, or unlawful manner;

(*f*) Every person who, with the intent to deceive the board, presents to the same as and for his own any diploma issued to another person;

(*g*) Every person who presents or exhibits to the board a forged or false diploma, or a diploma falsely or fraudulently obtained, knowing such diploma to be false or to have been obtained in a false or fraudulent manner, with the intent to deceive the board;

(*h*) Every person who presents or exhibits as a lawful certificate any forged or false certificate or any certificate obtained in a false or fraudulent manner, knowing the certificate to be false or to have been falsely or fraudulently obtained;

(*i*) Every person who knowingly practices veterinary medicine or attempts to do so, or holds himself out to be a veterinarian under cover of a false or forged certificate or of a certificate falsely or fraudulently obtained.

Enacted, February 11, 1913.

THE COLLEGE OF VETERINARY SCIENCE, UNIVERSITY OF THE PHILIPPINES.

By D. B. PALMER, D. V. M., and VICTOR BUENCAMINO, D. V. M., *University of the Philippines.*

The establishment of the College of Veterinary Science of the University of the Philippines is a direct result of the devastation wrought in the Philippine Islands by rinderpest and represents an effort to combat the disease by training men for the purpose. It is an interesting fact that the very first veterinary colleges in the world were established in Europe for the same purpose and that the desired results were accomplished. A reason for the establishment of the veterinary college of nearly as great importance was the fact that hitherto no facilities existed for the training of men for general veterinary practice.

The College of Veterinary Science derived its origin from the act founding the University of the Philippines which was passed June 18, 1908, in the special session of the First Philippine Legislature. The first session of the college began in June, 1910. To aid in the establishment of the college the Second Philippine Legislature, by Act No. 2040, established 20 scholarships for worthy Filipinos, and appropriated the sum of ₱3,500 to maintain the same for the first year. On January 27, 1912, it further appropriated the sum of ₱7,000 for the maintenance of 20 of these scholarships during the college year 1912–13. A further impetus to the study of veterinary science was given by the Third Philippine Legislature when Act No. 2245 was passed, which act provided for a board of veterinary examiners to control the granting of licenses to practice veterinary medicine and to safeguard the interests of such members of the veterinary profession as receive its license.

The aim of the college is to maintain the highest standards in every particular which will lead to turning out men with the highest educational equipment for the task confronting them. The aim is not to give a great number of students a poor training, but rather to give the very best to a few.

Admission is restricted to students who have graduated from

Philippine high schools that maintain a four-year course and who in addition are free from entrance conditions.

The curriculum of the college embraces work for five years of nine months each, leading to the degree of doctor of veterinary medicine. A portion of the instruction given in the first year of college might be classed as preparatory study, but allowing for this, the period of instruction exceeds that of a four-year course given elsewhere. These standards exceed those of most of the veterinary colleges of the United States and make the institution comparable in the features mentioned with only the very best of the American institutions. It is believed that only two veterinary colleges in the United States maintain even a four-year course.

The faculty consists of five veterinarians, three of whom devote full time to instruction. In this connection it should be observed that all the laboratory and general-science subjects are taught in the college of medicine and surgery, a division of the university which maintains exceedingly high standards. Instruction received there in such subjects as pathology, bacteriology, physiology, etc., is supplemented by work given by veterinarians.

At the present time the main buildings of the college are situated at Pandacan, one of the suburbs of Manila, and are in close proximity to the Pandacan quarantine station of the Bureau of Agriculture.

The clinic of the College of Veterinary Science is located between Rizal Avenue and Calle Tayuman, occupying a site adjoining the grounds of the San Lazaro Hospital. This place was formerly the immunizing station of the Bureau of Agriculture. Having been abandoned for this purpose, the Bureau of Agriculture has given the university the privilege of using the same for a veterinary hospital. The site was chosen because it is favorably located to draw clinical material from the north and central districts of the city of Manila, on account of the large pasture grounds near by, and, further, on account of the stables already available.

At present there is one building, two stories high. The upper floor is divided into three rooms, two for the use of student internes and one for an office and the storage of drugs. The lower floor is the entrance for patients and at the same time the room for surgical operations on small animals. There are on the grounds three long open sheds, with 40 stalls each, built for cattle. These are now being used for patients. In one of the spaces between two of the sheds there is a smaller shed with a wooden operating table for cattle, which takes the place of a surgical room for large animals. There is also, in the extreme south end of the grounds, a screened shed used for contagious infectious diseases.

When the clinic was first opened there were very few cases received because of the prejudice due to a belief existing that an animal which entered the hospital was as good as dead, the same being invariably shot by the veterinarian in charge. This was due to the fact that cases of surra and glanders were taken there by veterinarians of the Bureau of Agriculture and killed. It was difficult to overcome this prejudice, but to-day it can be safely stated that this has been done.

The clinic, during the school year, is open in the afternoon from 1.30 to 4. The owners are given free consultation and the animals free treatment. A nominal fee for feed, sufficient to pay expenses only, has been charged in cases where animals have had to remain in the hospital. The policy of administering free drugs was deemed advisable at first to draw clients; however, the clinic is so well established now that there will be a very nominal charge for drugs.

The clinic has been conducted since November 14, 1912, and has proven highly popular. From the date mentioned till June 14, 1913, there were entered 510 cases of disease, distributed among 457 animals. The majority of cases treated were horses, followed in number by dogs, cattle, swine, carabao, sheep, goats, and fowls. The horses are mainly the property of public-rig owners and proprietors of livery stables. The cattle brought to the clinic have been for the most part for castration, there being considerable of this work done on cattle shipped to the provinces for draft purposes. The small-animal clinic has not been as large as might have been expected because a majority of cases have been refused for lack of adequate quarters.

Many of the animals presented are owned by poor people who would not otherwise have their animals treated, and thus the work has brought relief to many suffering dumb brutes.

During the third year of instruction there were 26 students registered and at the present time, immediately before the beginning of a new year, 21 applications from qualified candidates are on file in the office of the dean, which will assure a 50 per cent increase at least. This, in itself, will show the impetus that has been given veterinary education in the Philippines.

THE SURRA-CONVEYING FLY OF THE PHILIPPINES AND SOME FACTORS CONCERNED IN CONTROL MEASURES.

By M. BRUIN MITZMAIN,
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In a campaign for the eradication of surra it is imperative to locate the guilty insect carriers before preventive measures can be undertaken, for it has been shown in many tropical countries that when the sources and modes of conveyance of infection have been exactly determined, relatively simple and effective measures can be adopted. In this connection the finding of insect carriers in the rôle of intermediate hosts of the trypanosomes of surra, or the knowledge that a cyclical development of the organisms takes place in the body of the insect, are questions of importance. As has been indicated by Bagshawe, it appears that an epizoötic of surra may be started from an animal in the blood of which trypanosomes are scarce. If it were known that one species of insect alone is capable of becoming infected from such a host and that flies of this species transmit infection to other animals for a period of many weeks, such knowledge could not fail to lead to precision and hence economy in preventive methods.

In view of the importance of this matter, the writer has instituted a series of studies undertaken to incriminate or to exclude from future practical consideration the various species of bloodsucking insects that might be concerned in the transmission of surra. *Stomoxys calcitrans* Linn. was first studied with reference to the possibility of its being the agent in the transmission of surra by mechanical transmission and with reference to the possibility of a cyclical development of trypanosomes in this insect. The results published in detail elsewhere[1] were such that this fly may be regarded as practically a negative factor.

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[1] Philippine Journal of Science, Sec. B (1912), Vol. VII, pp. 475–519, and Bull. No. 24, Bureau of Agriculture, Manila, P. I.

Experiments with *Tabanus striatus* Fabr. yielded positive results, and it is now for the first time announced that the common horsefly of these Islands is a carrier of surra. This was the result of recent experiments conducted at the veterinary research laboratory at Alabang, the details of which will be described in forthcoming publications.[1] Unlike all other experiments with horseflies in other countries, the material used was a series of flies bred under observation in the laboratory, thus excluding any possibility of previous contamination. The transmission of surra was effected by the direct mechanical method, thus simulating the conditions of interrupted feeding of horseflies in nature.

Recently, the breeding places of this fly have been located. Previously, a fruitless search in the vicinity of Alabang along the small rivers, tide-water canals, and rice paddies had been conducted through a period of six months. The shore of Laguna de Bay was finally investigated with the result that many larvæ and pupæ were unearthed which developed into the recognizable adult forms of *Tabanus striatus.* A chain of barrios extends along the lake from Taguig to Muntinlupa in Rizal Province, and similar relations exist in the Province of Laguna. The dwellers have made vegetable gardens on the water front which are in cultivation for only part of the year. During the rainy season from July to January these garden lots are submerged. Toward the end of this period the lake water has receded somewhat. Usually before January 15 plowing commences, carabaos being utilized for this purpose. Beginning March 1 crops are harvested and in some instances the ground is replanted. This continues throughout the dry season.

The carabaos used for plowing the gardens in January are fairly covered with bloodsucking flies. Tabanids are present in abundant numbers. The eggs of these flies are laid on driftwood and rubbish in the standing water, and when hatched the larvæ bury themselves in the wet sand. Their food is supplied by the countless minute crustacea of the lake shore, and principally by the larvæ of the Muscid flies which are laid in the carabao manure. Several instances have been noted of *Tabanus* larvæ being seen buried in the manure in quest of food.

Thousands of full-grown larvæ and pupæ of the *Tabanus* fly have been found buried to a depth of 4 to 6 inches (1.02 to 1.53 decimeters) in sandy soil in the environment described. These, when collected and transferred to vessels in the laboratory, began to develop into adult flies March 1, 1913. As late as April 15, 1913, a great number of full-grown larvæ have been collected from gardens along the lake shore, so that it may be stated with certainty that several broods of *Tabanus* present themselves and that these broods overlap one another. Since it has been ascertained that the developed larva requires three weeks to complete its transformations, the emergence of flies in abundance may be anticipated in the Provinces of Rizal and Laguna in the latter part of April and the middle of May.

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[1] Philippine Journal of Science, Sec. B (1913), Vol. VIII, and Bull. No. 28, Bureau of Agriculture, Manila, P. I.

This information regarding the breeding habits of *Tabanus striatus* suggests a future possible line of attack to be directed against the surra carrier. The possibility of eradicating the fly in the larval stage offers a new problem for consideration.

Records of the number of individuals of the suspected insect carriers infesting animals at various seasons of the year have been made at the veterinary research laboratory at Alabang. These records are of value in checking results obtained from experiments in insect transmission. Several instances are cited here to exemplify the importance of this study. The facts are gleaned from the records of two years' observations taken at Alabang. During this period weekly or biweekly counts were taken of flies collected from various hosts so that the initial appearance and the seasonal preponderance of biting flies were accurately noted. Likewise spontaneous cases of surra among the work animals were noted and an attempt made to trace their origin. Of course, any evidence obtained even under the most painstaking surveillance would be essentially circumstantial, and this should be borne in mind when the findings are judged.

In 1911, on December 27, three carabaos used at the veterinary research laboratory as draft animals were found positive for surra. Incidentally, these animals were immediately isolated and were destroyed a few weeks later. In attempting to trace the origin of the infection it was discovered that in an adjoining corral three experimental carabaos which had been inoculated with rinderpest blood had likewise contracted surra. It is assumed, since the rinderpest carabaos were recent additions and no other animals were found harboring the trypanosomes at this time, that the possible source of infection was found in the experimental carabaos. At any rate, the six carabaos were in the open and exposed to the same insect carriers. The fly records show a marked preponderance of horseflies (*Tabanus striatus*) for this time and the month preceding.

In January, 1912, under the same environment, surra appeared in a horse quartered in a shed near the veterinary research laboratory. This was also a spontaneous case. Unfortunately, the case was not recognized as surra until several days after the initial rise of temperature, and the source of infection was not ascertained. However, again referring to records of fly enumerations it was seen that during this period *Tabanus* was present in relatively large numbers among draft animals kept in the open corrals.

The experimental data compiled from the foregoing observations made under practically field conditions have an important bearing on the epidemiology of surra. Certain other possible carriers were present to assume a rôle in these two instances. Besides *Tabanus,* the biting flies present in numbers sufficient so that they could not be regarded as negligible factors were *Stomoxys, Lyperosia, Hippobosca,* mosquitoes, and midges. The stable fly, *Stomoxys calcitrans,* has been eliminated in a rather exhaustive set of experiments, so that for the present discussion it may be regarded as practically a negative factor. *Lyperosia* and *Hippobosca,* two genera of flies which have been investigated from the standpoint of mechanical transmission, may also be eliminated. Mosquitoes, which have been investigated more or less thoroughly in Africa and India, may likewise be eliminated for the present on account of the negative results which followed the experiments conducted here by the writer. Midges, the *Chrinomidæ,* which are often present among the draft animals of the Philippines in tremendous numbers, may be still held under suspicion, although workers in Africa and India have dismissed these insects from serious consideration relative to disease transmission.

Thus by the above process of rather hypothetical elimination additional evidence is adduced by which *Tabanus,* the horsefly, is incriminated. It has been ascertained that a species of the *Tabanidæ* in northern Africa is a carrier of trypanosomiasis very similar to that of surra. *Tabanus* has been proved experimentally to be one of the carriers of surra in India and in the Federated Malay States.

Until such time as the common species of bloodsucking insects may be eliminated as factors in the spread of surra the question of distribution of biting flies will influence the work of control. If definite information can be ascertained regarding the preponderance of certain species at every season for a given locality, the work of prophylaxis may be simplified. To be sure, this applies more directly to regions where the specific insect carrier is suspected or known.

Under ideal conditions the seasonal counts should be obtained monthly from the principal infected foci, or at any rate from the three geographical divisions of the Archipelago. From the records gathered by trained observers, the appearance of suspicious flies could be made the working basis for control measures. In this manner, and in this manner alone, accurate knowledge could be procured regarding the coincidental appearance of surra outbreaks and suspected insect carriers. Alabang, Rizal, and possibly Manila, are the only two points concerning which the writer has accurate information of fly distribution.

Of extreme importance in connection with the spread of surra is the predilection of bloodsucking flies for particular hosts. Certain it is that if suspected flies are not attracted by the host infected, disease does not result. The attraction, for instance, may take the form of color, odor, and degree of temperature. In the matter of color, certain flies are attracted toward white, but most species are attracted by dark animals. In regard to horseflies, the carabao is unusually favored in infestation by these persistent pests. During the season when *Tabanus* is prevalent, in one instance 61 of these horseflies were collected in less than fifteen minutes from a carabao kept in an open corral in Manila.

The relation of temperature to parasitism is, in the opinion of the writer, of some economic importance, although thus far the matter is rather in the theoretical stage. It has been experimentally demonstrated by Howlett in India that mosquitoes are positively attracted by a temperature higher than the normal. This theory may be extended to the bloodsucking flies generally. Other things being equal, the mammalian parasites are attracted toward an animal of high temperature. It has been asserted in all seriousness by Grassi, the Italian expert on mosquitoes, that these insects are attracted to persons who talk a great deal.

Under field conditions it is often observed that an animal, through physical injuries, bruises, etc., has a slightly higher temperature than its fellows. If one observes closely, it will be found that the injured animal attracts more biting flies than normally, and the consequent inroads of surra may be due to this factor or to the lowered resistance of the animal.

In relation to parasitism on animals in general it appears that *Stomoxys calcitrans*, the stable fly, attacks all with equal avidity if not interrupted in the attempt. It is easily recognized why sick animals are marked for their attacks. It has been observed and confirmed by several investigators that infected animals, particularly horses, are more susceptible to the attacks of *Stomoxys* than are healthy horses. During an outbreak of surra two years ago it was noticed in a Government corral that three horses among a large number of work animals contracted surra probably several days before the malady was diagnosed. The attention of the veterinarian in charge was not attracted primarily by the clinical symptoms but more particularly by the unusual number of biting flies present upon one of the sick animals. This latter did not attempt to dislodge the parasites, and the flies were permitted to feed until engorged. The three horses were examined for blood parasites and found positive for surra with numerous trypanosomes. In this instance there was an interesting correlation between the number of blood parasites and the preponderance of biting flies. One horse, which had attracted attention on account of the number of flies infesting it, was found to harbor the greatest number of blood parasites. Incidentally, when the three sick horses were isolated the epizoötic was immediately checked.

In the matter of the destruction of horseflies, insecticides have been used, but these have proved more or less unsatisfactory. Substances acting as repellents have had a more favorable application, but direct methods of destruction have proved unavailing. The most useful application of these measures has been exerted in relation to the aquatic habits of *Tabanus*. Professor Hine has employed petroleum for spraying on the surface of stagnant water over which *Tabanus* eggs are laid, so that the larvæ when they hatch must pass through a film of oil. This is supposed to be quite effective against the adult flies which visit the water for drinking purposes. The same investigator provides a most effective measure of reducing the number of *Tabanus* flies by gathering and destroying the eggs. He records the results of an hour's work in the collecting of 433 masses of eggs which aggregated an estimated total of 108,250 single eggs.

In the Philippines the only remedial measure that has been applied for this species is the destruction of the adult flies, which are found at times in swarms on rain trees. Here they may be either collected with a net or trapped with tree tanglefoot applied to the trunk and larger branches. The destruction of trees and brush and other favorable resting places for horseflies in the vicinity of animal sheds and corrals is an important consideration.

It is not sufficient that the infected animals be isolated, but it is essential also that they and the healthy stock be protected from attack by flies. The use of fly screening for surra animals would, to be sure, aside from immediate destruction, afford the ideal protection. This, of course, may be extended to insure protection of valuable stock, studhorses, etc., especially during such periods when dangerous flies prevail. If screening is found to be impracticable, a considerable protection can be obtained in the use of darkened sheds, in the use of animal sheds exposed to strong winds, and in sheds and corrals distant from bodies of water.

Animals at work or at pasture may be covered with a protective wash. Sores and skin abrasions of all sorts should be kept covered with tar or some other antiseptic greasy substance disagreeable to flies both of the bloodsucking and nonbiting species. The latter should not be ignored as factors in surra dissemination, for it has been proved that these flies act as passive parasites in drawing blood from wounds produced by the proboscides of *Stomoxys* and *Tabanus* and are capable of producing infection by mechanical means of contamination.

In general, the influence of a dark stable is quite marked in reducing the number of all species of flies which obtain access to draft animals. It is recommended that animal sheds be constructed with the roof as low as the height of the animals will permit. This can be done without interfering with the supply of fresh air. One research worker states that he found surra unable to spread among animals kept in a stable of this sort, but when they were tied immediately outside of the protection afforded by the low roof the animals contracted surra. In this stable, during one entire surra season in India, only two or three *Tabanus* flies were found on animals.

No excuse will be offered for assuming that all flies inhabiting stables and corrals are to be treated with suspicion in connection with control measures. Whether or not all of the bloodsucking flies have been proved to play a rôle, or whether or not the nonbiting flies are a practical factor in surra dissemination, a generous policy in suppressive measures should include all for reasons to be determined later. The presence of the house fly, representing the nonbiting flies, aside from the fact that it is an evidence of bad sanitation and doubtless a dangerous factor as regards several diseases, has been proved to be instrumental in the distribution of surra.

In the disposal of animal manure it is necessary to consider the breeding habits of the parasitic flies. It has been ascertained that some species breed only in certain manures. The horn fly will not breed in horse manure, and the stable fly breeds rarely in carabao manure. Emphasis should be laid on the fact that the all-important *Tabanus striatus,* the horsefly, does not normally breed in manure, and when young forms of this fly are placed experimentally in great numbers in manure of various kinds the fly does not mature.

Concerning the disposition of fecal matter, it has been recommended that all offal should be burned immediately after the end of the rainy season. If this is not practicable, the accumulated manure should be sprayed with insecticides or treated by some other direct measure to insure the destruction of larvæ and pupæ. If these methods are not sufficient, they may be supplemented by natural enemies of the manural fauna, notably predaceous beetles and ants.

In relation to such parasites as the *Lyperosia* and *Stomoxys* flies, the standard means of control recommended may be applicable to the Philippines. Means are taken to prevent the abundance of the flies by the destruction of fly larvæ in the dung and the protection of the animals from attacks of the adult fly. The direct measures of destruction recommended as a partial means of reducing the number of adult insects are not always practicable and have little utility in the case of grazing animals on a large range.

Lime has been used effectively to destroy larvæ inhabiting the dung. This is advantageous in small pastures at the time of the year prior to the appearance of the first brood of flies. This is obviously a means of reduction of flies in the immediate vicinity of the animal sheds. Any means providing for the rapid dessication of the animal droppings are, to be sure, commendable, and this is effected in some localities by spreading fresh manure by various mechanical means, including the questionable practice of utilizing pigs for this purpose.

The use of repellents in the form of greasy substances has a limited application in mitigating the evil of fly infestation. A great many oils and fats have been experimented with, and insecticides acting more or less as temporary repellents have been discovered. The mixtures are usually applied with the addition of some antiseptic, to assist in healing if any sores are present. When applied in the dry season the wash must be renewed every two or three days. It may be unnecessary to attempt to protect the entire animal, but only those parts inaccessible to the head and tail of the fly-infested animal. The following substances have been given a rather extensive application by the United States Bureau of Entomology: Fish oil alone, or mixed with sulphur and carbolic acid; kerosene emulsion alone, or tobacco water added; and in addition resin and oil of tar. For the control of flies infesting large herds of bovines the use of cattle-tick dipping vats with a suitable insecticide has been recommended. This has been applied with phenomenal results in parts of Texas.

Speaking of novel methods of fly destruction, the writer is tempted to refer to tests made, in modern times, of fly repellents by two quite distinguished German chemists. Seriously, since little else more practicable is offered, the principle involved may be after all a dependable solution. Tests were made concerning the action of potassium tellurate as a repellent for mosquitoes, flies, and ticks. The chemical was administered in the form of an insectifuge in the drinking water of nine horses and a cow. Ten grams were used for each animal in doses of 1 to 5 grams. Only negative results were obtained, the experimental animals continuing to be annoyed by flies. However, experiments with oleum lauri as an insectifuge are said to have given quite positive results.

OBSERVATIONS ON THE CLINICAL DIAGNOSIS OF GLANDERS.

By C. H. SCHULTZ, *Veterinarian, Veterinary Research Laboratory, Alabang, Rizal.*

With the advancing knowledge of medicine, the subject of prophylaxis is steadily assuming a more important place, especially as related to infectious and epizoötic diseases. Diseases that are transmissible from animals to the human family have, during the last three decades, received special attention. If we can reduce the number of animals affected, and reduce the number of carriers of germs destructive to animals and man, we reduce the mortality among our population and limit economic losses.

In no other class of diseases is it so necessary to establish, at the earliest possible moment, a correct positive diagnosis as in outbreaks of epizoötic diseases.

Among this class of maladies, glanders has always been recognized as of the utmost importance, because it is fatal to man and because the economic losses to the community through death of horses are great.

In order to control an outbreak of glanders successfully, a positive identification of the disease affecting the living horse is necessary. At times easy, it is often very difficult to establish a diagnosis that will be supported by post-mortem examination.

Many different methods have been advanced by numerous investigators, not one of which, however, answers all phases or all conditions brought about by the contagion. Besides considering the history of the suspected animals and clinical appearance at the time, the veterinarian must be familiar with the different special methods that have, from time to time, been brought forward to detect obscure cases of glanders.

1. The consideration of the clinical symptoms, subjective and objective, as they present themselves upon a careful physical examination of the animal is most important and may decide the case. Since, whenever the clinical diagnosis is at fault,

a serious loss to the owner results, it must be supported by other special methods. Therefore we have to consider:

2. The excision of an enlarged gland and its microscopic examination.
3. The cultivation on suitable media of the organisms causing glanders derived preferably from excised tissue.
4. The inoculation of susceptible animals.
5. Auto-inoculation.
6. The subcutaneous injection of mallein.
7. The cuti reaction, now discarded.
8. The agglutination method.
9. The precipitation reaction as improved by Konew.
10. The complement fixation reaction.
11. Post-mortem examination whenever possible.
12. The ophthalmo reaction, or, if we are more careful and correct in our expression, the conjunctival reaction.

It is scarcely necessary to dwell upon the drawbacks of these special diagnostic methods. Veterinarians are all familiar with the limitations of the mallein test, as an example.

Considering the sero-diagnostic methods, we must say that they can be carried out only in properly equipped laboratories. During the early stages of the disease, the complement fixation test used by Mohler (1) often fails to give positive results. Whenever the animal has been infected ten days or more this test is, however, the very best method to detect glanders infection.

Among all these methods the busy clinician finds but one by which he can distinguish in a prompt and satisfactory manner animals that show obscure symptoms, or differentiate other diseases with symptoms similar to glanders.

About 1907 Vallée attempted to diagnose glanders in horses by the introduction of mallein into the conjunctival fold of the lower eyelid. He soon discarded the method as unreliable. Several investigators, however, were busy in devising methods suitable for clinical examinations.

Schürer (2) reported favorably on the conjunctival reaction as early as 1908, and its extensive use in the Austrian military service since then has demonstrated its value.

Fröhner (3) published a very complete report, covering observations upon 21 horses affected with glanders. The diagnosis of all these cases was verified by the introduction of 2 drops of a solution of 5 centigrams of dry mallein Foth dissolved in 4.5 cubic centimeters of 0.5 per cent solution of carbolic acid. After twelve hours in positive cases a large quantity of purulent or muco-purulent discharge agglutinated the eyelids. Its production was continuous for twelve to thirty-six hours, more or less, in different cases. The discharge was pale yellow in color with a tendency to become viscid. The long hairs on the eyelids soon became matted together, especially near the inner canthus, and the discharge was often so profuse that it ran down over the cheek. The conjunctiva was markedly congested and sometimes the eyelids were swollen. The same amount of the same mallein solution applied into the lidsacs of healthy animals failed to produce any disturbance whatsoever. The reaction in these horses was typical, although the temperatures of the animals were high, between 38.5 and 39.5° C., which would prohibit the mallein test as usually applied. These 21 positive conjunctival reactions so carefully described by Fröhner were checked up with the complement fixation tests and the post-mortem reports, the results corresponding.

In 1911, Muller, Gächtgens and Aoki (4) published an interesting article on the relative value of sero-diagnostic methods and the conjunctival reaction as applied to glanders suspects among horses. From their observations they draw the conclusion that the introduction of a suitable mallein solution into the eye is the best and most practicable method to diagnose occult and doubtful cases of glanders.

In an exhaustive illustrated article Miesner (5) compares the results obtained with the complement fixation test, the agglutination tests, and the conjunctival reaction.

All these tests were executed with great care, the results are published in comprehensive tables, and they are substantiated by careful post-mortem reports.

One hundred and thirty-three glanders suspects were tested by the three different methods, and the results are compared and analyzed. As a diagnostic agent he used 3 centigrams of dry mallein Foth dissolved in 3 cubic centimeters of sterile normal salt solution. The solution was applied by means of a pipette or camel's-hair brush to the conjunctival fold of the lower eyelid. The reaction appeared in six to twelve hours and expressed itself in a pronounced discharge from the inner canthus which was muco-purulent, adhering to the lower lid, sometimes running down the cheek. In some cases a pronounced edematous swelling of both eyelids could be noted which produced a glassy appearance of the lids. Marked congestion of the conjunctiva and often complete agglutination of both lids were produced.

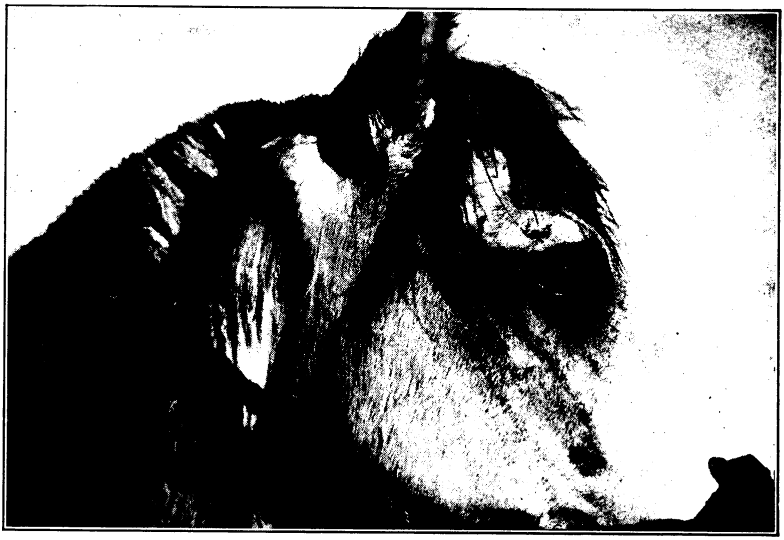

Photo by Dr. W. H. Boynton.

(*a*) Native pony, before introducing mallein solution into the eye.

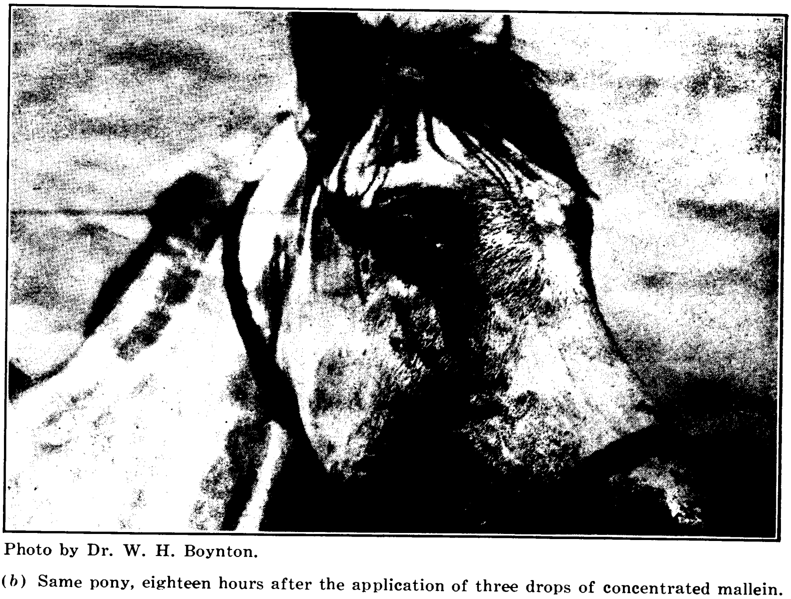

Photo by Dr. W. H. Boynton.

(*b*) Same pony, eighteen hours after the application of three drops of concentrated mallein.

Typical positive conjunctival reaction.

After from fourteen to twenty-four hours the eyes began to clear up. Among 133 animals examined 59 glandered horses were diagnosed through the complement fixation test, an accuracy of 100 per cent. Fifty glandered horses were detected by the agglutination method, which number constituted 84 per cent of the cases detected by the complement fixation test. The conjunctival reaction detected 53 cases, or 90 per cent, of those shown by the complement fixation test. The complement fixation test did not condemn any healthy animals. The agglutination test condemned 2 horses, or 2.7 per cent of the healthy animals. The conjunctival test produced no reaction in sound horses.

The local application of a suitable mallein solution into the eye did not influence the sero-diagnostic methods.

From Java there is at hand a report of the work of Dr. L. de Bliek (6), director of the veterinary laboratory in Buitzenborg (Nederlandish India), who also indorses as simple and reliable the instillation of a solution of crude mallein into the eye. The conditions prevailing in this tropical region are similar to the Philippines and the animals affected show similarity in conformation and uses. The report considers every phase of diagnostic methods, compares the results of the agglutination and the complement fixation test, the subcutaneous injection of mallein, and the conjunctival test.

Results obtained with the last-named reaction were so satisfactory that De Bliek uses it in preference to older methods and hopes to eradicate the disease from the Island of Java by its systematic application.

Ten cases of strangles, 4 of saccharomyces, 5 of osteomalacia, and 1 of chronic catarrh of the sinuses did not react to the eye test.

Personal experience of the present writer, in four widely separated localities, has demonstrated the conjunctival reaction to be satisfactory and simple. During an investigation of an outbreak of contagious disease among native ponies at Calamba belonging to the Philippine Sugar Estates Development Company, its application gave negative results. *Streptococcus equi* was subsequently isolated from the afflicted animals, thus identifying the disease as strangles.

A glanders suspect was tested at the clinic of the College of Veterinary Science, University of the Philippines, and gave a positive reaction. The same animal was again tested at the veterinary research laboratory at Alabang. Its temperature was 39° before the subcutaneous injection of mallein and did not rise during the following forty-eight hours. The swelling around the point of injection was 5 by 7 centimeters, hot and painful, and remained until the animal was destroyed. The application of 3 drops of concentrated mallein into the left eye produced after twelve hours a profuse pus-like discharge, pale yellow in color, which adhered to the hairs and to the inner canthus of the eye. The conjunctival membranes appeared inflamed and swollen; the pus flakes would at times cover the entire cornea. The condition is well illustrated in Plate II. Post-mortem examination showed changes characteristic of glanders in the lungs, liver, and on the nasal septum. *Bacterium mallei* was recovered from guinea pigs inoculated with pus from the submaxillary glands.

The same concentrated mallein was introduced into the eyes of five native ponies, selected at random, without, however, producing any changes. The mallein used in these tests was made from old cultures of *Bacterium mallei* at the veterinary research laboratory at Alabang.

In order to obtain a specific conjunctival reaction in animals affected with glanders, it is necessary that no irritating substances shall be present in the test fluid used, and that only a specific, intense mallein reaction be obtained. Five per cent sterilized aqueous solution of carbolic acid or preferably sterile normal salt solution are the solvents used to make up a 1 per cent solution of dry mallein Foth. It should be freshly prepared; 2 or 3 drops are applied to the conjunctival membranes of the lower lid. This may be done with a pipette or with a camel's-hair brush. A small hypodermic syringe with a short blunt needle is quite suitable.

The changes considered indicative of a positive reaction appear in six to twelve hours and usually begin to recede after twenty-four hours. If the reaction proves uncertain, the application should be repeated in the same eye in the same manner twenty-four hours after the first instillation. According to Miesner, this will show no increase if negative, or a marked increase if positive.

The test cannot be repeated afterwards, since the membranes of the eye become accustomed to it and fail to react in a typical manner for some time. The other eye can then be used.

The ease of application, the ready manner with which the necessary materials can be obtained and carried, the simple interpretation of the results, visible to the veterinarian and owner alike, the rapidity with which a great number of animals can be passed upon, have at once recommended the conjunctival reaction to our profession. It produces a typical reaction even when the animals have high temperatures, as in the cases reported by Fröhner.

An important fact in its favor, so far as present reports are available, is that it does not condemn horses that are not affected with glanders. In addition, it is an easy matter to test the solution on healthy animals or to accept the nonreactors as checks.

The clinician who is often in trouble when he meets glanders suspects has, therefore, at his command a diagnostic method at once reasonably correct (90 to 94 per cent) and simple, and independent of the laboratory methods, something that will permit a vigorous fight along rational lines against one of our most dangerous diseases. It is of the utmost importance to be able to verify the physical examinations at once, and identify such a high per cent of occult cases without having to refer to distant laboratories.

Recently a disease resembling glanders has been reported in the Island of Catanduanes, and the authorities of the Province of Albay together with local horse owners have applied to the Bureau of Agriculture for assistance. The writer is at present engaged in field work on that island designed to control the disease. A comparison will be made of the accuracy of the various means for recognizing glanders, such as clinical diagnosis, the subcutaneous inoculation of mallein, the agglutination methods, the complement fixation reaction, and the ophthalmo reaction. All will be supplemented wherever possible by postmortem examination, the results of which will set the standard with which to compare the accuracy of the various tests.

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RINDERPEST QUARANTINE IN LA UNION PROVINCE.

By JOHN D. REARDON, *Veterinarian.*

The topography of La Union Province is such as to present less difficulties in controlling the movement of animals than that of the provinces comprising the extensive central valley of Luzon. It occupies a long, rather narrow strip between the China Sea and the Gulf of Lingayen to the west and the Sierra de Ilocos on the east, is bounded on the south by Pangasinan, and on the north by Ilocos Sur. It is the southernmost of three provinces comprising the northwest coast of the Island of Luzon, all very similar in topography—the other two being Ilocos Sur and Ilocos Norte. All these provinces devote a great deal of attention to the breeding of carabaos, and annually send thousands of animals southward into the central valley.

The southern boundary of La Union, extending from Rabon on the coast to Camp One at the foot of the mountains, is only 12 kilometers in length. In the early part of 1912 a fence was constructed along this boundary in order to enable the Bureau of Agriculture to maintain an adequate check on all animals moving southward from the Ilocos coast.

This fence has five strands of barbed wire with posts 5 meters apart, the top wire 1.6 meters high. It is guarded by a force of 2 American and 12 Filipino inspectors. The fact that this fence has not been cut during the entire time that the Philippine Scouts have been employed on rinderpest eradication in La Union shows that the barrier on the south is sufficient. The seacoast along the boundary of La Union on the west is of such a nature that it is impossible for a vessel large enough to carry cattle to land at any point with the exception of Rabon, San Fernando, or Darigayos. Therefore the question of efficiently guarding the seacoast did not present much difficulty. The same is true of the roads and trails leading from La Union through the mountains on the east into Benguet Subprovince. The only trail that at all times is open is the Naguilian trail leading from Naguilian, La Union, to Baguio, Benguet, and there connecting with the Baguio Road through Camp One into Pangasinan. Therefore, with the Naguilian trail guarded on the east, and the Pangasinan–La Union boundary fence on the south, together with a small guard on the seacoast, the probability of animals being able to pass from La Union, or the Ilocos Provinces to the north, into central Luzon are practically nil.

Scattered outbreaks of rinderpest have occurred along this coast for several years past. While the presence of the disease has not seriously crippled the animal-raising industry of these provinces, nevertheless it has been a constant menace to the central valley owing to the thousands of animals continually being sent to that section.

After the completion of the Pangasinan–Union fence, plans were made for a campaign of rinderpest eradication in the three coast provinces, to be carried on by the Bureau of Agriculture in conjunction with the Philippine Scouts. It was decided to start at the southern boundary of La Union and work northward, searching each municipality in succession and continually maintaining an east to west cordon.

On October 16, 1912, two companies of Philippine Scouts were detailed for duty in the Province of La Union. This force was augmented from time to time until at date of writing, February 1, 1913, six companies are on duty in the province. The Twenty-third Company commenced work in Santo Tomás, the southernmost town of La Union. They inspected northward through the towns of Santo Tomás, Rosario, Agoo, Tubao, Aringay, and Cava, taking in at the same time the adjoining townships in Benguet Subprovince which were situated east of La Union and west of the first high range of mountains. All of these municipalities were placed in quarantine for an observation period of fifteen consecutive days. All carabaos and cattle were tied up at least 20 meters apart with strong ropes not exceeding 1 meter in length. No work passes, or, in fact, movement of animals of any nature, were allowed during this fifteen-day tie-up. The usual sanitary measures were strictly enforced. All owners were obliged to provide each animal with food, water, and an individual drinking vessel. Thus, if any disease was subsequently discovered, the possibility of infection by direct contact or through utensils was avoided as much as possible.

No passes were given at any time for animals from other municipalities to pass on the road through municipalities in which the observation tie-up was in progress. Rinderpest was discovered in none of the municipalities lying south of Bauang.

The day that the Nineteenth Company, Philippine Scouts, was moved into Bauang, November 5, 1912, rinderpest was reported by the municipal president, and subsequent investigation by Bureau of Agriculture veterinarians showed four barrios infected with a total of 8 cases.

Three of the four barrios infected did not show cases after a period of ten days, but the fourth, namely, the central part of the town, continued to show new cases until December 15. It is considered that this was largely due to the fact that the central barrio covers a small area and contained so many animals that it was impossible to keep them the proper distances apart. Then, too, the center of the town was so thickly populated that there was considerable danger of indirect infection.

After the first ten days a night guard was placed on the central barrio to prevent any possibility of night pasturing.

The fact that the disease was not of a virulent type, the death rate being only 30 per cent, would also tend to show that there might have been some mild cases which escaped recognition.

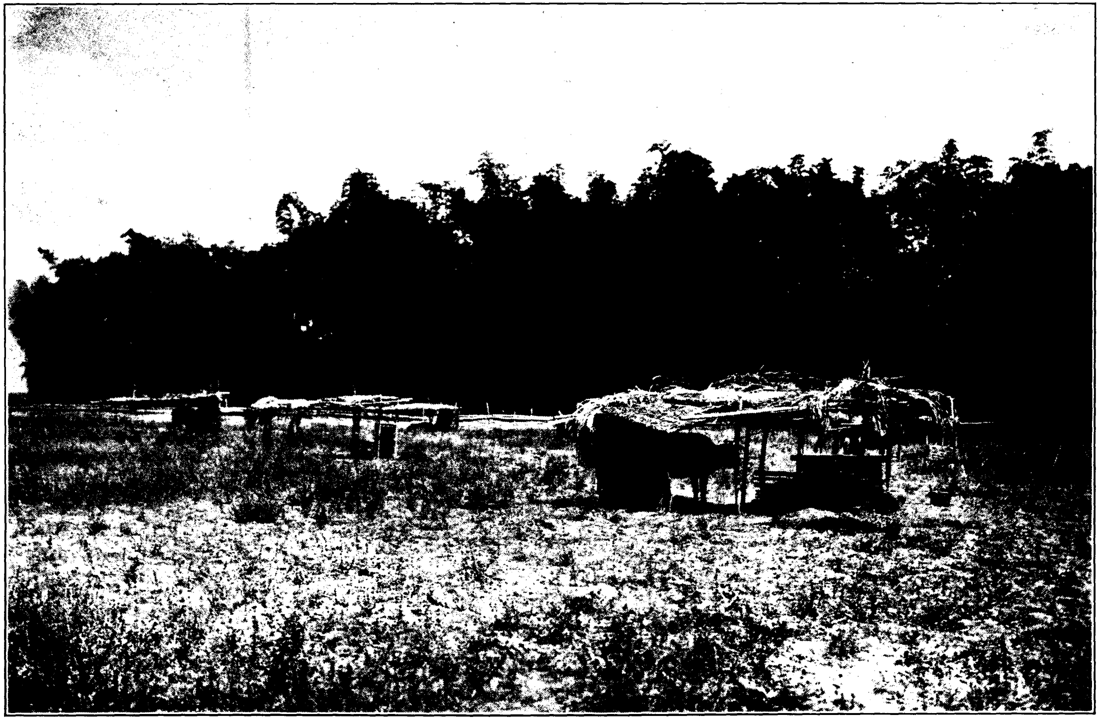
From the time that the Thirty-fifth Company, Philippine Scouts, entered Naguilian, December 29, 1912, the movements of the Scout companies have been so arranged as to move northward in an unbroken line, thus preventing infection of the territory to the south which had already been inspected by the Bureau forces in conjunction with the Twenty-third Company, and had been declared as clean territory. Rinderpest was discovered in Naguilian, a municipality lying east of Bauang, on November 16, 1912. The disease in Naguilian was traced and showed that it had been brought in from Bauang.

A small Bureau of Agriculture force succeeded in cleaning up Naguilian by the usual quarantine system employed in La Union, but with the very fortunate additional advantage of being ably assisted by intelligent municipal officials.

The president of Naguilian personally visited all infected barrios and barrios adjacent thereto, and explained the method of quarantine, and the necessity of coöperation by the people. He also stated that he would be obliged to deal severely with any persons found guilty of disregarding the quarantine regulations, explaining that such persons were a constant menace to the successful eradication of the disease.

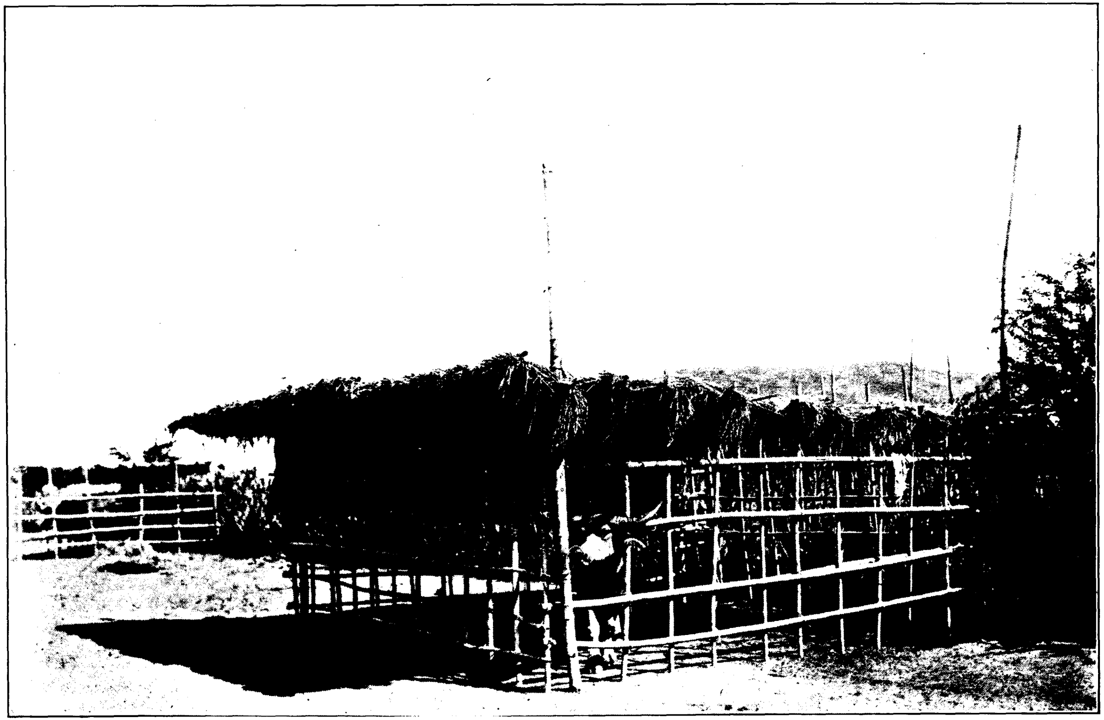
The fact that no case was discovered in Naguilian after November 21 shows the effective results that can be obtained, providing the Bureau has the hearty coöperation of the officials and people at large.

PLATE III.

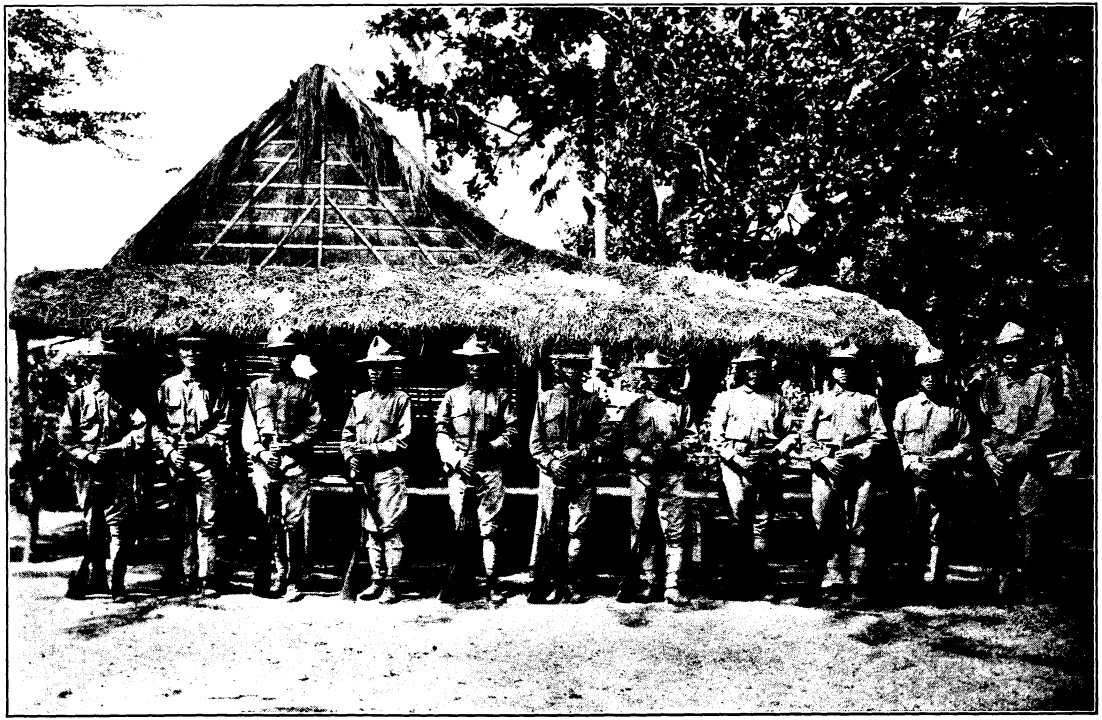


Method of isolating individual animals exposed to rinderpest by tying under sheds.

PLATE IV.



Method of isolating individual animals exposed to rinderpest in closed corrals.



Outpost of Philippine Scouts on rinderpest quarantine duty.

All of the municipalities of La Union lying south of San Fernando have been thoroughly inspected and at the present time are free from rinderpest.

The first case of rinderpest occurred in San Juan October 19. This municipality has remained infected to the present date, but as only one case has appeared in the last twenty-five days, the prospects for the early eradication of the disease are encouraging.

The infection was so widely disseminated prior to the quarantine (and the disease was of such a mild type) that undoubtedly several cases escaped detection. This is considered the underlying reason for the continued appearance of isolated cases.

After the fifteen-day period of observation quarantine, the barrios in San Juan not actually infected were allowed liberty, but were subject to a triweekly inspection.

This method was found to be unsuccessful, as the people, thinking there was no quarantine outside of the infected barrios, did not always present their animals for inspection at the appointed time. Also, in order to avoid quarantine the people hid the infection.

In this way rinderpest was introduced into San Fernando on December 4, 1912. After this occurrence it was found necessary to enforce the stricter quarantine measures in force in the other infected districts in the province.

The last case in San Fernando occurred on January 14, 1913, and present indications are that the spread of the disease in this locality has been checked. Bacnotan is at present the only municipality in which cases of rinderpest are prevalent.

The following is the method employed in municipalities occupied by the Philippine Scouts where rinderpest is discovered: The entire municipality is considered infected and all animals are tied up 20 meters apart in all the barrios with the exception of the infected barrios and barrios lying contiguous thereto. No movement of animals for any purpose is allowed in the municipality for fifteen days. An isolation corral is constructed in the infected barrios in accordance with standard Bureau specifications. In addition to this a bamboo obstruction is constructed 50 meters distant from the isolation corral. A Scout guard is placed outside of this quarantine line whose duty it is to see that no one enters other than the caretaker or authorized agent of the Director of Agriculture.

All animals, in the infected barrios and adjoining barrios as well, are placed in individual corrals, 3 meters square, at least 40 meters apart, and wherever possible not less than 100 meters from a house. These individual corrals are constructed of bamboo or other suitable material and are not provided with gates. The owner is required to provide two short bamboo ladders in order that he may be able to climb over the fence and enter the corral to clean it. A depository 1 meter deep for the refuse is placed just outside of the corral, and a drinking vessel is placed in each corral. These individual corrals are provided with ample shade and are placed, whenever possible, in an open field. It is believed that a great deal of infection is carried because of the fact that all of the family and relatives of the owner of a sick or exposed carabao or beeve gather around the infected animal, and after examining it and placing their hands all over its body, return to their respective homes and examine their own animals to see if they are in the same condition. It has been observed that a large number of people will gather around the animal in this manner in places where ample natural shade is provided, but very few people care to go out into the open fields in the hot sunlight and discuss rinderpest. The construction of the individual corrals without gates is considered essential so as to prevent people from pasturing their animals at night.

Permits to work are given in the noninfected barrios after the completion of the fifteen-day tie-up and twelve days after the discovery of the last case in the infected barrios. When permits are given to work, the owner is obliged to construct an individual corral on the piece of land which he desires to cultivate and the animal is required to be in the corral at all times when not at work. No animals of the class affected are allowed to pasture until thirty days after the appearance of the last case of rinderpest; in other words, no pasture permits are given until the municipality in question is entirely released from quarantine. When enough Scouts are available, night guards are placed in the infected barrios.

A separate census is taken by the Bureau force and Scouts, which is checked over by the veterinarian with the commanding officer of the company. The following method is employed by the Bureau inspectors in taking the census: A list is made of the owners or caretakers and the number of animals that each owner has; this census is then checked with that taken by the Scout soldiers, and if any discrepancies are noted they are at once investigated, which precludes the possibility of either the soldiers or inspectors shirking their duty; with this preliminary census a Bureau inspector other than the one who took the first census is required to list the animals in each barrio on the prescribed Bureau of Agriculture form. The point is, an accurate check of all animals should be obtained during the first five days of the quarantine so that an absolutely effective observation period of ten days may obtain.

The results obtained would seem to show that this method of quarantine is effective.

Since the 1st of January the rinderpest force and the provincial officials have worked in harmony. The provincial governor has sent letters of instruction to the presidents of the towns infected, and has addressed large meetings at the municipal buildings in the interest of the quarantine.

The work accomplished in La Union Province outside of the Scout force is not discussed here, as it was not in charge of the writer.

RINDERPEST IN THE AMBURAYAN RIVER VALLEY.

By C. H. DECKER, *Veterinarian.*

The municipalities of Balaoan, Luna, and Bangar are situated in the Amburayan River Valley, the most fertile valley in the Province of La Union, which comprises approximately 100 square kilometers. There are between 8,000 and 9,000 carabaos in this district, and rinderpest has been very prevalent here for the last three years. During the early months of 1912 there occurred more than 300 cases and again in September, 1912, disease was reported in Balaoan and Luna.

At the beginning of this outbreak the work was rendered difficult, as the people, especially in Balaoan, were very much opposed to the measures adopted, entertaining the idea that they would rather have their animals die than undergo the quarantine. A great many animals were taken to the hills before the work was well organized, but a searching party of soldiers of the Philippine Constabulary and inspectors of the Bureau of Agriculture was formed later and sent through this section, bringing back all of the animals.

The whole country was flooded owing to the incessant heavy rains, making it impossible to use horses in inspecting the barrios. All the men were obliged to wade through mud and water in the performance of their duties.

Fifteen barrios in Balaoan and one in Luna were immediately found to be infected and about four weeks later disease was found in Bangar. Here it existed in 21 out of the 22 barrios, and also in 3 more barrios of Luna contiguous to Bangar.

On the first appearance of rinderpest in a barrio, the people were called together for the purpose of explaining to them the nature of the disease, the quarantine methods about to be used, and the necessity of pursuing such rigorous methods. At first the educational propaganda was not very much of a success, as all the Ilocano inspectors were inexperienced, the experienced men being the Tagalogs, who were unable to speak the dialect.

Animals were all tied in individual corrals, separated, whenever possible, by a distance of 20 meters. Mother and calf were placed in the same corral which, whenever possible, was separated 40 meters from any of the others. In some cases it was very difficult to isolate the corrals on account of the inadequate space, as the fields were nearly all cultivated and inundated. Each animal was provided with an individual drinking vessel. A small can of disinfectant was placed at each corral and instructions given to the owner to disinfect his hands and feet every time he fed or went near his animals.

It was subsequently discovered that owners were taking their animals out of the corrals, and in order to prevent this all corrals were built without gates.

In the barrios where the disease persisted, night patrols and inspections were maintained, and in this way, although very difficult at times, the progress of the disease was checked. Also near all centers of infection in the barrios, all individual corrals were disinfected twice daily and only one person permitted to care for a group of animals.

When the quarantine force entered the municipalities all barrios were tied up and inspected daily for at least fifteen days and then if not infected the people were given work passes in their respective barrios, except in the case of barrios contiguous to others which were infected. In these, work passes were issued when it was thought there was absolutely no danger of spreading infection. In the infected barrios no passes were given until at least fifteen, and in most cases twenty, days had passed without the discovery of new cases. In all the barrios, both infected and noninfected, the owners were obliged to construct provisional corrals on the land to be cultivated and animals, while not working, were kept in these. Animals were not allowed to work at night in order to prevent any pasturing, which is generally the case when the people ask for work passes to be used at night.

Barrios would appear to be clean and then a case or two would break out again; in some barrios fifteen to twenty-five days elapsed between cases. This would make it seem as if animals were pasturing in infected barrios or going into other infected territory. However, all barrios were kept tied up until the end of the outbreak and animals were not permitted to pass from one clean barrio to another without a pass and also under guard, so as to prevent any danger of their going near infected territory or territory deemed to be dangerous. The fact is that the rinderpest in the Amburayan Valley was of a mild type, and it is the opinion of the writer that in barrios where long intervals occurred between clinical cases, animals had the disease in such mild forms as to be unrecognizable, and the contagion was therefore spread to the other animals of a group by their caretaker. It is well known that caretakers are negligent in regard to disinfecting their hands and feet after tending to each individual animal unless they are constantly watched, and of course this is impossible without an exceptionally large force of guards.

In the municipality of Luna only four barrios were found infected, but all animals in the municipality were tied up and inspected daily for twenty-five days and all barrios contiguous to infected barrios and to Balaoan and Bangar were tied up till the end of the outbreak. This was done without any protests whatever from the inhabitants, as the officials were helping as much as possible, especially the president, and instead of the people complaining about the quarantine they coöperated in working to stamp out the disease.

In Tagudin and Suyo, which were later infected, restraint of animals in individual corrals was more satisfactorily accomplished and the barrios were more easily cleaned and kept clean on account of it being the dry season. Here in all infected barrios, animals were separated at least 30 meters, for all rice had been cut and it was possible to build the corrals in the fields.

The Constabulary soldiers were used mostly for night patrols and rendered good service all through the outbreak, although few in number. Sixty enlisted men and two officers were on duty.

The extent of the infection and number of cases and losses are shown in the following table:

Rinderpest statistics in the Amburayan River Valley.

Towns.	Barrios infected.	Cases of rinderpest.	Deaths.
Balaoan	15	60	30
Luna	4	13	9
Bangar	21	114	34
Suyo	1	9	3
Tagudin	7	73	30
Total	48	269	106

The death rate of those discovered to be infected was found to be 39.4 per cent.

KIDNEY-WORM INFESTATION OF SWINE.[1]

By WILLIAM HUTCHINS BOYNTON,
Pathologist, Veterinary Research Laboratory, Alabang, Rizal.

Kidney-worm infestation may be regarded as an infectious disease of swine of which the specific cause is *Stephanurus dentatus,* a worm 30 to 40 millimeters in length. The parasites may be located in the fat surrounding the kidneys, in the ureters, encysted in the kidneys, liver, spleen, lymph glands, muscle, and connective tissue of both abdominal and chest cavities. The worms may also be found free or slightly embedded in the connective tissue of both cavities. The disease is characterized by muscular pains, tenderness to pressure over the kidneys, weakness, loss of appetite, emaciation, and partial or complete paralysis of the hind quarters.

From the reports at hand kidney-worm infestation appears to be more prevalent in the temperate and tropical climates than in the colder latitudes. It has been found in the United States, especially in the southern part. It is also present in South America, Australia, Asia, and the Philippine Islands.

The writer has had opportunity to observe the results of kidney-worm infestation in a herd of 20 thoroughbred pigs, the individuals of which were imported at various times from the State of Texas, United States, and from Australia.

The animals were maintained in the best sanitary conditions, being housed and kept on cement floors which were washed daily. The refuse was carried away through a sewer and never came in contact with the pigs. Each compartment had a small runway for the animals to get out on the ground. They were not crowded, for very seldom over 5 or 6 animals were kept in the same pen at one time. None but the boar came in contact with native pigs. Shortly before a sow was ready to give birth to pigs, she was placed in a pen alone, and kept there until the litter was old enough to wean. The only time during which a large number of pigs were together was after they were weaned. Those of nearly the same age were placed in a large pen by themselves. When they reached a certain age, the animals to be kept for breeding purposes were taken out and the rest were sold.

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[1] To appear in detailed form in the Philippine Journal of Science, Sec. B.

The first noticeable symptom is a stiffness of movement, as if the animal was suffering from muscular pains. This is especially perceptible in the hind limbs. As the disease progresses the animal becomes lame and weak in the loins. During this stage it lies down most of the time, and does not rise to its feet unless urged. In some cases, a few days before death, the animal loses partial or complete control of the hind quarters. There is tenderness over the kidneys, and the animal winces when pressure is applied to the back. Pigs usually eat fairly well up to within a few days of death, when they refuse food entirely. They generally become emaciated, but the reverse has been noticed in two cases where the animals were in good condition at the time of death. Dropsy was present in 3 of the 6 cases examined.

In the 6 animals examined, the worms were found both free upon, and inclosed in, the fat surrounding the kidney, in the ureters, in the pelvis of the kidney, and encysted in various parts of the kidney. They were found free in the abdominal cavity and often partially embedded in the connective tissue, not having as yet become encysted. They were found free on the surface of the liver, encysted in the connective tissue around the large blood vessels of that organ, and encysted inside of the liver, either in accumulations or singly. They were found embedded immediately under the surface of the liver and encysted in adjoining lymph glands.

In every case the liver was distended, soft, and of a dark purplish color. The borders of the lobes, instead of tapering down to a rather thin edge, were distended and rounding. In some instances collections of gas bubbles were noticed under the covering of the liver, suggesting that putrefaction was taking place rapidly. The dependent portions of the lobes of the liver were of a uniform dark purplish color and the individual lobules were not distinguishable through the capsule. The upper portion of the lobes had a mottled appearance. The majority of the lobules in some cases were of a dark-purple color, while the remaining lobules varied from a purplish tint to a gray-brown color. Upon section, the liver was soft, bulged out on the incised surface, and the borders of the lobules were indistinguishable. The lobes were adherent to each other by a gray, felt-like, fibrinous deposit. This was especially prominent in the dependent portions. In three cases the liver was adherent to the diaphragm, breastbone, and stomach.

Several instances were noted where branches of the veins of the liver had been plugged up by deposits. The obstructions are undoubtedly the principal agents which cause the damming back of the blood in the liver.

The kidneys show as marked a deviation from the normal as does the liver. Sacs containing worms or decomposed worms are distributed throughout the organ. Scars may be observed on the surface of the kidneys in places where these cysts have been. In some cases the organ may for this reason exhibit a shrunken, uneven appearance, or the kidney may contain so many cavities as to roughly resemble a coarse sponge. Worms in sacs or changes due to their disintegration are likewise to be found in various lymphatic glands in the abdominal cavity.

Several writers state that the worm is never found in the interior of the kidney. This may be true in those cases noticed in the abattoirs where the infestation is not of long standing, but if one were to examine animals which have died of the disease he would find the kidney structure to be invaded in a majority of the cases.

Worms were found in great numbers encysted in the connective tissue along the back, especially in the neighborhood of the kidneys. In two cases the connective tissue along the spinal column extending from the tail to the diaphragm was a mass of cysts, most of them containing one or two worms and filled with purulent material. In three cases worms were found in the chest cavity, both free and embedded in the walls. One worm was found partly embedded in the lung tissue. They were also found embedded in the diaphragm. Thus it will be seen that when an animal dies of kidney-worm infestation, the disease takes on a generalized instead of a localized aspect, characteristic of earlier stages of the disease.

One of the most prominent changes to be noted at post-mortem examination is the rapidity with which the internal organs decompose. Four of the six animals were examined shortly after death, and upon autopsy the viscera had a pungent odor as if decomposition of the organs was well advanced.

Since the worms are encysted in the solid tissues and are surrounded by a purulent débris, treatment with vermicides introduced by the mouth is very unsatisfactory. Remedies could never be expected to reach the worms in sufficiently concentrated form to have any beneficial action. Hence, preventive measures are of more than usual importance.

Various investigators have come to the conclusion that the worm passes no part of its cycle of life in any other animal than the pig. Therefore every effort must be made to break the chains of succession in the reproduction of the worm by preventing uninfested animals from coming in contact with infested ones or with their excretions.

Law, in his Veterinary Medicine, states that "hogs should be excluded from all ground known to be infested, or on which infested hogs have been, or which receives drainage from fields, lots, or pens occupied by other hogs. * * * Above all, the pigs should be kept apart from slaughterhouses and streams into which they drain, and on no account should they be allowed the offal or flesh of other pigs, including scraps from the kitchen, until such material has been thoroughly cooked. * * * As in the case of other communicable diseases of pigs, the massing of these animals in large herds in contaminated localities is particularly dangerous. * * * Purchased pigs should be added to sound herds on the basis of irrefragable evidence of the soundness of the herds and the locality from which they came, and even then only after quarantine."

In Asia in certain localities this disease is very prevalent. The only way it can be controlled to any extent is by placing the pigs on slat floors, which allows the urine and feces to drain through. In this way the uninfested animals are not so apt to come in contact with the infective material.

A NOTE ON KIDNEY-WORM INFESTATION OF SWINE AS SHOWN POST-MORTEM AT THE MANILA MATADERO.

By R. W. NEWCOMB, *Veterinarian.*

The serious results caused in imported swine by *Stephanurus dentatus,* as reported by Dr. Boynton in his paper on this same subject, suggested an investigation of the prevalence of this parasite in native hogs killed at the Manila matadero. The conditions there permitted the gathering of information regarding the distribution of this parasite in the southern part of central Luzon.

At intervals of two weeks the writer has examined for the presence of these worms all of the swine slaughtered on a given day at the Manila matadero. In all about 2,000 hogs have been examined, and very nearly 50 per cent of all the swine slaughtered have been found infested.

Of these swine approximately 20 per cent were brought to Manila from the Province of Batangas, 20 per cent from Bulacan, 10 per cent from Cavite, 10 per cent from Rizal, 3 per cent from Zambales, and 1 per cent each from Tarlac, Pampanga, and Nueva Ecija. About 15 per cent were raised in Manila. The balance were from various districts. The origin of a few could not be traced.

The parasite is a round worm, varying from 30 to 40 millimeters in length, and pointed at both extremities. It is of a grayish-white color and more or less transparent, so that its spiral-shaped alimentary canal, which is black in color, is readily distinguishable.

The parasites are most commonly found in the fatty tissue posterior to the kidneys, though they may be found in the hilum of the kidney or even in the kidney tissue itself, and occasionally in the mesenteric fat, the psoas muscles, and the neck of the bladder. Tubular tracts are formed of hard connective tissue sometimes as large as a pencil, and having very thick walls. Often a sort of nest is formed, composed of many convolutions of a single tube or of several of the tracts combined. These nests are often 2 or 3 inches (50 or 76 millimeters) in diameter. When found in the kidney tissue the parasites are usually very small. They cause destruction of portions of the kidney with a subsequent formation of scar tissue which upon contraction distorts the surface of the kidney to a marked degree, so that it is often possible to detect an infested kidney by its exterior appearance.

In chronic cases these tracts are often filled with a very dark brown serous fluid which is evidently a secretion of the parasite. Adhesions of the intestines to adjacent organs or other parts of the intestines are rarely found and very rarely an acute peritonitis due to perforation of the intestines or kidney.

However, out of 71,060 native swine examined at the Manila matadero during the past fiscal year, only four cases were found where the acute peritonitis was severe enough to warrant condemnation of the entire carcass, such is the apparent resistance of the native swine to the invasions of this parasite.

Pigs up to the age of 6 or 8 months are rarely found infested, and old breeding sows are rarely free from infestation.

It will readily be seen that owing to the location of these worms it is impossible to treat this condition with medicine, and it is equally evident that this parasite is bound to be a severe obstacle to the introduction of pure-blooded swine to these Islands.

A NOTE UPON STRANGLES IN THE PHILIPPINE ISLANDS.[1]

By William Hutchins Boynton,
Pathologist, Veterinary Research Laboratory, Alabang, Rizal.

It is believed by some members of the medical profession that streptococcic infection in man is of rare occurrence in the Philippine Islands, and, when present, is mild in effect.

Since the diseases prevailing among the domesticated animals have not been worked out to any great extent here, it is not positively known whether or not they suffer from such infection.

The existence of strangles or distemper in horses appears to have attracted very little attention in the Philippines, and although it has been recognized several times by veterinarians, the diagnosis in such instances was based entirely upon clinical symptoms, the causative agent not having been isolated and identified.

In searching for official reports on strangles in the Bureau of Agriculture files, none could be found; but by personal inquiry the writer has been able to gain some data as to its prevalence.

During the months of February, March, and April, 1909, shortly after the arrival of some old Army mares for breeding purposes at the Alabang stock farm, there was an outbreak of strangles which killed several colts, and ran a severe course in many others. By the strenuous work of the men in charge the infection was cleaned up and has not appeared since.

There have been several outbreaks of this disease at the Trinidad stock farm during which several colts and older horses died. Veterinarians who have worked in Manila state that strangles is quite prevalent among the carromata horses, and also occurs frequently in the city stables. A few years ago this disease is said to have killed one of the finest race horses in the Philippine Islands.

Strangles appeared among the horses at the Singalong experiment station in Manila about March 10, 1911, and on March 26 horses which apparently had not been affected by the disease during this outbreak were shipped from Singalong to Trinidad. About the 15th of April the disease was observed among the animals at the Trinidad stock farm, but as the disease first appeared in a pony belonging to an employee at the experiment station, it is thought quite probable that the infection was brought in by this pony, rather than by the horses from Manila.

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[1] To appear in detailed form in the Philippine Journal of Science, Sec. B.

On April 3, 1911, the animal husbandry division of the Bureau of Agriculture shipped 11 horses suffering with osteoporosis from the Trinidad stock farm to the veterinary research laboratory at Alabang. The animals were transported in stock cars, arriving at Alabang in apparently good condition, except for the deformities caused by osteoporosis. They were placed in a shed previously occupied by cattle immunized to rinderpest which were used in the production of antirinderpest serum. Each horse was tied in a separate stall, but could easily reach over into its neighbor's manger on either side.

Case 1.—April 10, 1911, the writer's attention was called to a horse 1 year old which had a slight purulent discharge from its left nostril, the left submaxillary gland being slightly enlarged. The animal was immediately separated from the rest and its manger thoroughly disinfected. On the 16th of April this animal died. Post-mortem examination revealed typical osteoporosis lesions, the right femur being completely fractured about 3 inches from its head, and practically all the bones of the body were more or less affected, which was undoubtedly the cause of death. At the time of death the discharge from the nostril had practically ceased, but the affected gland was somewhat enlarged. Neither culture nor smear preparation was made from the discharge or gland of this animal.

Case 2.—April 17, a horse 1 year old which stood in the stall adjoining No. 1 displayed a purulent discharge from both nostrils. The animal was immediately isolated and the stall and manger thoroughly disinfected. On the 19th the submaxillary glands were enormously enlarged. Four days later an abscess broke, discharging a thick yellowish pus, and on the 26th two more abscesses broke. The horse was placed on the operating table and two more abscesses were opened with aseptic precautions. From these cultures were made on agar-agar and in plain bouillon. Several smear preparations were made and, after staining, showed upon microscopic examination large numbers of cocci and a few short chains containing from three to four elements each. On the 28th the agar culture showed several colonies of *Micrococcus pyogenes aureus* and *albus.* Besides these there were a few small grayish colonies which, upon microscopic examination of hanging drop and stained smear preparations, proved to be streptococci. Long chains of streptococci were also found present in the bouillon culture but were mixed with numerous micrococci. Subcultures on agar and in bouillon were made from the small agar colonies. On April 29 the subcultures in both media revealed pure cultures of streptococci.

On May 1, 1 cubic centimeter of bouillon culture was injected subcutaneously into each of 2 rabbits and 2 guinea pigs, and 5 cubic centimeters subcutaneously into the neck of a horse 1 year of age. The rabbits and guinea pigs suffered no ill effects from the injection. The horse on the second day after injection showed a large swollen area around the point of inoculation which was very tender. On the fifth day the swelling was 14 centimeters in diameter. The lymphatic vessels extending from it were swollen, giving an identical picture of a typical, local mallein reaction in a glandered horse. On the eighth day the abscess thus formed broke and discharged a large amount of yellowish blood-stained pus, which, upon microscopic examination of stained smear preparation, revealed large numbers of streptococci in short chains.

At the time the abscess broke the horse ate very little and had a depressed appearance, lying down most of the time. In a couple of days it regained its appetite, the swelling gradually subsided, and complete healing took place in fifteen days. The neighboring lymphatic glands were observed frequently, but no sign of enlargement or tenderness could be detected.

From all appearances this inoculated horse had a mild attack of strangles, the infection remaining localized at the point of inoculation.

Case 3.—On April 25, a 2-year-old horse which had stood beside the second case was observed to have a slight discharge from both nostrils. It was immediately isolated and the premises thoroughly disinfected. In three days it had a marked discharge from both nostrils, and both submaxillary glands were considerably enlarged. After ten days' duration the discharge ceased and the glands gradually returned to normal size. A few short chains of streptococci were found on microscopic examination of the nasal discharge. In fourteen days this animal had the appearance of being completely recovered from the attack.

Case 4.—On May 3, a small black mare 1 year old which stood beside the third case was observed to have a discharge from the right nostril. The animal was immediately isolated and the premises thoroughly disinfected. The following day there was observed a discharge from both nostrils and the submaxillary glands were slightly enlarged. At the end of ten days the discharge from both nostrils had ceased, and the glands were practically normal in size. Recovery was apparently complete in fourteen days.

From the results derived from the cultures and from microscopic examinations of the purulent discharges, it is evident that streptococci infection exists in horses in the Philippine Islands. Since bouillon cultures had no effect on rabbits and guinea pigs when inoculated subcutaneously, and did have decided effect upon a horse, it proves quite conclusively that the organism isolated was *Streptococcus equi.* No white mice were on hand, so the virulence of the culture could not be tested on them.

From the information gained through inquiry and the foregoing observations it is concluded that strangles is a widespread disease among horses in the Islands, an interesting fact in view of the reputed rarity of streptococcic infections in man.

THE LONDON EXPOSITION OF RUBBER AND TROPICAL PRODUCTS.

By O. W. BARRETT, *Chief, Division of Horticulture.*

In June, 1914, there will be opened in London a tropical exposition, theoretically of a twofold nature, comprising the Fourth International Rubber and Allied Industries Exposition and one of International Cotton, Fibers, and Other Tropical Agriculture Products and Allied Industries. This exposition will be held in what is unquestionably the best possible place for such an affair of world-wide interest, and both the producers of raw products and the manufacturers and dealers in both raw and finished tropical staples will have a rare opportunity to meet and compare notes in the midst of probably the finest display of this class of the world's merchantable goods the public has ever seen.

His Majesty the King of England is patron of the combined expositions, and the organizing manager is A. Staines Manders, esq., who organized the very successful Third Rubber and Allied Industries Exhibition in New York in the summer of 1912. The president of the rubber exposition is Sir Henry A. Blake, the ex-governor of Ceylon, Bahamas, Newfoundland, Jamaica, Hongkong, etc. The president of the cotton, fibers, etc., exhibition is Prof. Wyndham Dunstan, director of the Imperial Institute and president of the International Association of Tropical Agriculture and Colonial Development.

At first it was intended that the two exhibitions should be kept more or less separate, but since there are a number of countries preëminent in the tropical commerce of the world that are, nevertheless, unimportant as producers of rubber, and since they could not be expected to relish this arrangement, the committee on exhibits has agreed to combine the two exhibitions; both will now be held in the Royal Agricultural Hall, which is said to be the most conveniently located building in London.

The exposition will open on Wednesday, June 24, and will close on Thursday, July 9. While a fortnight is apparently too short a time for such a great undertaking, the amount of business which can and will be done in London in these few days is probably much greater than most residents of tropical countries not familiar with that city believe. Holding the exhibits open for only a fortnight reduces considerably the expense, and combining the two exhibitions is, moreover, a very pronounced economy.

Together with the double exposition there will be held simultaneously an international congress of tropical agriculture which will be attended by delegates from all parts of the world. There have been so many remarkable changes in the way of advancement in tropical agriculture during the last few years that this opportunity for experts in all branches of the profession to meet and discuss the dubious matters which are still to be settled will result in great good to the participating governments as well as to the scientists and planters themselves.

It is interesting to note that the management has decided to create a palms and palm-products section on account of the tremendous importance of the coconut and its rival the oil palm—not to mention nipa, burí, sago, and several of the India palms which are rapidly increasing in importance in commerce. It is expected that the cotton, fibers, and other tropical products will easily overshadow the rubber, though one of the prime objects of the exposition was the advancement of the rubber industry. When we realize, however, that the fibers are really of much more importance to the general public, to say nothing of the vast commerce (hundreds of millions of pesos) in tropical oils, sugar, goods, etc., the Philippine Islands, like India, must logically rejoice in the prominence of the nonrubber side of the double exposition.

The available space for the exposition covers an area of 18,580 square meters (200,000 square feet). The space rate is necessarily rather high—about ₱20 per square meter (4s. per square foot). Exhibits should be installed early in June—which means that the Philippine materials should leave Manila by the middle of April, 1914. It is hoped that the best exhibit of Philippine fibers, palm products, tobacco, sugar, grains, etc., ever shown can be gotten together by that time. While it is not advisable to show materials in such large quantities as will be required at the Panama exposition at San Francisco in 1915, a display of every commercial Philippine product, carefully arranged and classified, should be in evidence. It is necessary to economize space as much as possible, and with this end in view a large collection of photographs (many enlarged and colored) illustrating every phase of agriculture in the Archipelago, together with a set of natural-size water-color sketches of all Philippine fruits and vegetables, will be exhibited; the latter will attract the eye of the visitor, and both will be remembered even after the samples themselves, perhaps, are forgotten.

CURRENT NOTES—AUGUST.

NOTES BY O. W. BARRETT, Chief, Division of Horticulture.

ZOÖTECHNY AND COCONUTS.

In a recent number of Tropical Life, animal breeding on large coconut estates is advised. It is pointed out that in large estates, even if somewhat removed from good transportation routes, the coconut planter can very readily increase his income by turning his attention to this frequently very profitable branch of agriculture. The Bureau of Agriculture, also, recommended this policy in Bulletin No. 25, "The Philippine Coconut Industry."

In Ceylon, for instance, the matter is being given the best attention, and it is expected that not only horses but also cattle, pigs, sheep, and goats will soon be very much in evidence on the better-kept coconut plantations of the Malay States, the East Indies, and, let us hope, the Philippines. The matter of feeding large numbers of animals is, of course, a difficult question; but considering the fact that all modern coconut estates will have their own copra dryers and oil presses, the cake from the oil machines must needs be used locally. Maize leaves, stripped at the time of harvesting the ears, make very superior "roughage," and if properly handled a good part of the maize stalks can also be utilized. Most cover crops, such as cowpeas, peanuts, etc., can, of course, be used for forage.

DEODORIZED OILS.

We have some splendid new theories to help us out with the exasperating mysteries of osphresiology, but thus far we do not know much about the sense of smell; in fact, it now seems there may be several distinct ways of "sensing" an odor. In certain lines of commerce, such as the marketing of oil from rotten or smoked copra, rancid peanuts, and fermented cotton seed, the good "bouquet" or bad "taint" of the finished product is, in the opinion of the consuming public, a pretty serious matter.

The new superheated-steam method of blowing bad odors out of impure or olfactorily objectionable oils is due to revolutionize the trade. There is a question whether it will be possible to blow out all the creosote smell from the tapahan copra oil of the

Philippine Islands; but even if it does succeed it will, we hope, not materially lengthen the period of apparent popularity of this execrable product. Good nutty or fruity smelling oils will always be far ahead of the nonodorous or deodorized ones, for obvious reasons. For instance, the sardine canner will look with considerable suspicion upon an oil supposed to be made from olives which does not carry the characteristic fruit-like smell and taste of the genuine article.

The salient fact connected with this new deodorization method is that it gives the low-grade and impure cheap oils a better chance to compete with the ordinary product, and while it may be practically impossible to implant, as it were, a good natural odor into the "blowed-out" oils, it must be admitted that no odor in a food oil is much more to be desired than a foul one.

KAPOK PRICES.

We learn that in March over 20,000 bales of kapok were burned at Samarang, Java. This heavy loss, coupled with the 14,000 bales burned about the first of the year at Surabaya, Java, will, it is expected, considerably affect the price of that fiber.

The United States imported in the fiscal year 1912 some 2,000 tons of kapok fiber, mostly from Java. This material, which seems to be rather rapidly increasing in value, is now worth over ₱600 per ton.

ANOTHER NEW PAPER.

Economists have for some years been busy with the sudd problem of Upper Egypt. The vast papyrus-covered areas of the swampy region of the Nile contain billions of tons of vegetable fiber which, when properly handled, can be utilized for either fuel or paper pulp. This sudd is a sort of spongy peat and when properly bleached, ground, and pressed can very probably be turned to good account in helping to relieve the excessive demand on the timber forests. Recent experiments in England have gone so far as to leave only a little doubt as to the commercial success of this venture.

A NEW CULTIVATOR.

From La Vie Agricole we learn of a new "automobile" cultivator. This machine, propelled by a small, light (2 to 4 horsepower) gasoline motor, is merely steered by the laborer who walks behind it. Any variety of attachments, such as hoes, shovels, harrow teeth, etc., may be attached to the base of the frame. This handy machine is mounted on three wheels, two of which are connected with the motor. According to the particular model, the width of the strip cultivated is from 60 to 110 centimeters. We hope this apparatus will solve many of the orchardists' and horticulturists' difficulties in the way of rapidly and cheaply weeding and "dust mulching" fruit trees, gardens, and small plantations.

PINEAPPLES.

The public is apparently becoming almost ravenous for pineapples, fresh and canned. The growing importance of the industry in the Philippines is a pleasing feature of our new agriculture. The large plantation near Cabanatuan, Nueva Ecija, is reported as particularly promising, and the cannery will soon be ready for business.

The present outlook for a big crop in Cuba is good; considerably over one million crates will be turned out, mostly for the United States trade.

Unfortunately, Hawaii is prohibited from exporting fresh fruit to the United States on account of the terrible fruit-fly pest, but the canned article will, of course, go forward unhindered.

MAIZE SUGAR.

For the past three or four years sugar agronomists have had considerable worry, not to say trouble, over the possibility of the "common or garden variety" of maize rivaling cane in the sugar market. The United States was one of the first countries to investigate this matter and apparently the first to turn it down. However, now that India and Rhodesia (south-central Africa) have revived the interest in this very important subject, it behooves even the Philippine planter to experiment along this line.

The secret of the matter is, of course, known to the whole world, and there can never be any patent process in it except in some minor detail of the methods of extraction. The fact is, according to all records of experiments at hand, the maize plant when deprived of the ears at about the time starch is being deposited in the kernels, i. e., when the seed is "in the milk," does develop a remarkable saccharose, or, rather, glucose, content. Sugar cane is considered above the average if it analyzes 13 per cent of sucrose; it appears that the agricultural chemist of the Rhodesian Government finds as high as 12½ to 14 per cent of sugar and about 1 per cent of glucose in the decobbed maize stalks in his experiments; some of the Indian experiments at Pusa indicate that as high as 9 per cent of the weight of the maize stem may be turned into sucrose by the artificial upsetting of the normal physiological function of this crop, which some experts believe will be, through its wonderful variability under the hybridizer's hands and its adaptation to man's varied needs, the greatest crop of the future.

SOUTH AFRICAN LOCUSTS.

Locust swarms continue to be a very severe plague in the greater part of the Union of South Africa. A government locust bureau is maintained there and it seems to be kept exceedingly busy. Instead of the "pit method," which is almost absolutely necessary in a thickly settled country like most of the districts of the Philippines, where domestic animals are usually very much in evidence and frequently roam at large, the South African locust bureau depends entirely upon arsenical sprays for the destruction of the hoppers. This arsenate of soda stock solution is prepared by the government experts and distributed to the centers of infestation as occasion requires. In some districts the shortage of water is a very serious drawback, considering the fact that it takes from 50 to 65 parts of water to dilute the locust poison.

Sometimes, but rarely, it is possible to dig up the eggs if the swarm has oviposited in a level cultivated sandy area. A case in point occurred (during the writer's administration as Director of Agriculture for Mozambique) in the Zambesi district in 1909: Some 17 tons of migratory locust eggs were dug up by cheap native labor (mostly women and children) within the space of some 100 hectares on a sugar plantation in about two weeks' time—this constituting what will probably long remain the world's record for locust-egg destruction by hand.

SUNFLOWER SEEDS.

Recent trials at the Singalong and Lamao experiment stations indicate that several varieties of sunflowers grow fairly well here. One head weighing 1.7 kilos has just been harvested at Singalong.

Sunflower seed is now quoted at about ₱0.13 per kilo in England. There is also an increasing demand for the "cake" from the oil press. This seed stands long-distance shipping well. The oil content is about 32 per cent, or just one-half that of copra.

AMERICAN TRADE.

American merchants and commercial companies have been for many years criticised pretty severely for having made so little progress, comparatively speaking, toward getting the bulk or at least the cream of the South American and oriental trade. The Panama Canal is supposed to be able to remedy some of the backwardness, if it is such, of American commerce. However, we must never lose sight of the following very important yet not generally appreciated fact: The home trade of the United States of America is something like ten times as great as the combined foreign trade of all the nations of the world put together. Logically, then, it is little wonder that American commerce can find no time to bother particularly with such a rather troublesome long-distance trade as that of the Philippines and the South American continent.

WHALE MEAT.

The popularity of whale flesh in Japan is steadily increasing. For several years past this meat has been used both fresh and canned very extensively in that country, and there are now in active commission a considerable number of whaling steamers hunting in the waters of Korea and southern Japan, the Oriental Whaling Company having 12 "whalers" constantly engaged. Over 100 whales were killed during last December in the Chosen Seas.

According to quality, the flesh is worth from ₱0.20 to ₱0.30 per kilo. Setting aside an unreasonable prejudice, there is only one good reason why we should not use the excellent-appearing meat of this wholesome warm-blooded animal (whose ancestors in the geological epochs are believed by some zoölogists to have been related to the cattle and swine of to-day), which is that in spite of the fact that the muscle substance is practically free from the fat and blubber blanket, it has a decidedly strong fishy taste and odor.

Recently, whale hunting has been very successful in the neighborhood of the Fiji Islands, and numbers of whalers are bound thither lured by the great profits of the trade.

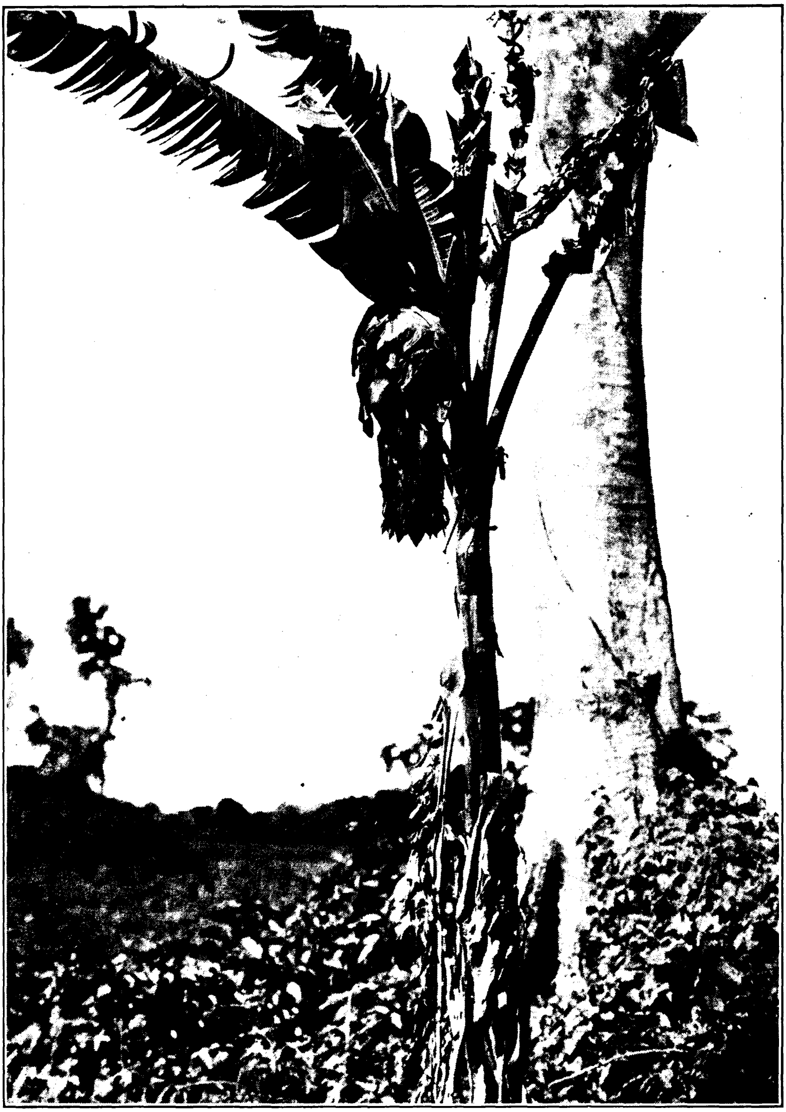
TEMPERATURE AND RAINFALL FOR AGRICULTURAL DISTRICTS IN THE PHILIPPINES.

By the DIRECTOR OF THE WEATHER BUREAU.

MAY, 1913.

[Temperature and total rainfall for 24 hours beginning at 6 a. m. each day.]

Date.	Abaca (Manila hemp).				Sugar, Iloilo.		Rice, Tarlac.		Tobacco.			
	Albay.		Tacloban.						Aparri.		San Fernando.	
	Temperature.	Rainfall.	Temperature.	Rainfall.	Temperature.	Rainfall.	Temperature.	Rainfall.	Temperature.	Rainfall.	Temperature.	Rainfall.
	°C.	*mm.*	*°C.*	*mm.*	*°C.*	*mm.*	*°C.*	*mm.*	*°C.*	*mm.*	*°C.*	*mm.*
1	27.9	-------	27.3	2.3	27.8	-------	30.4	-------	27.2	-------	27.3	-------
2	27.7	49.3	26.2	10.9	27.5	-------	30.3	-------	27.3	-------	28.7	-------
3	25.7	28.2	25.3	30.7	25.8	6.1	30.4	-------	26.8	-------	28.2	-------
4	27.8	43.5	25.8	72.7	27.9	-------	30	-------	27.2	-------	28.5	-------
5	25.8	97.8	24.9	143.4	27.6	2.8	30.4	-------	27.3	-------	27.1	-------
6	26	14.5	27.3	2	25.2	78.4	27.4	4.1	26.6	5.4	28	-------
7	27	.8	27.1	1.5	26.1	-------	27.5	1.8	25.8	5.1	27.4	8.1
8	27.4	-------	27.6	.5	27.4	-------	26.2	24.1	27.9	-------	24.4	5.4
9	28	-------	28.1	-------	27.5	1	27.2	10.5	25	131.4	24	35
10	27.8	-------	28.2	-------	28	2.8	27	8.1	26.2	1.3	25.6	22.1
11	28.4	-------	28.5	-------	28.2	-------	27.8	-------	27.4	-------	26.3	24.4
12	28.3	-------	28.3	-------	28.4	-------	28	-------	26.9	3.8	28.2	-------
13	28.6	-------	28	-------	28.6	-------	29.6	-------	27.8	-------	28.8	-------
14	28.8	-------	28.4	-------	28.4	3	29.3	-------	28.4	-------	26.8	-------
15	28.5	-------	28.3	4.3	28.1	-------	29.6	-------	28.3	-------	27.6	-------
16	28.8	-------	28.3	-------	27.8	-------	29	22.1	27.6	-------	27.4	9.1
17	28.4	-------	28	-------	28.1	-------	29	20.3	27.2	9.2	26.4	-------
18	28.8	1	28.1	29.7	28.3	-------	29	5.1	26.8	3	26.8	-------
19	28.2	25.1	27	-------	25.8	1	28.8	-------	27.2	16	27.6	-------
20	28	1	27	8.4	28.4	-------	28.4	-------	26.7	-------	27.4	-------
21	28.6	1.5	26.9	4.1	28.6	12.4	28.9	-------	27.7	-------	27.4	-------
22	27.6	11.5	27.4	.8	27.8	-------	29	-------	27.6	-------	27.5	-------
23	28	3.1	27.2	7.6	28.2	-------	29	-------	28.2	-------	27.6	-------
24	27.4	1.3	27.4	1.8	27.3	19.5	29	10.2	28.5	-------	-------	-------
25	28.2	-------	27.2	4.3	25.9	.5	28.2	-------	28.8	-------	-------	-------
26	28.8	-------	27.6	-------	26.9	10.2	29.2	12.7	28.3	-------	27.8	4.1
27	29.2	1	28.2	-------	27.6	7.1	29.5	33.3	28	-------	26.8	2.5
28	28.7	-------	27.9	1.6	27.5	11.7	28.2	-------	28.4	-------	28.2	.8
29	29	24.1	27.2	-------	28.1	-------	29.2	-------	29	-------	28.2	-------
30	28.7	.3	27.6	13.4	28.6	-------	29.2	-------	28.7	-------	27.4	-------
31	29	10.4	26.3	3.5	28.4	-------	29	-------	28	-------	27.9	-------



"Virgen" banana, an unidentified wild species, having the fruits covered with husks.

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EDITORIAL.

AGRICULTURE AND PROSPERITY.

Comparatively few years ago agriculture was looked upon in a condescending way by those engaged in other occupations, and it was generally believed that no skill and but little intelligence were needed in order to "farm." In our day and generation this sentiment has experienced a great change, for with the great discoveries and advances that have been made in agricultural chemistry, pathology, bacteriology, and thremmatology—to mention a few of the numerous 'ologies pertaining to agricultural science—it is now well recognized that in the keen competition of to-day the tiller of the soil is but poorly equipped to compete with his fellow men unless he has acquired some technical knowledge.

That the governing representatives of the enlightened nations of the world also recognize the close relation of an agriculturally well-educated farming class to the general prosperity of a country is shown by the fact that most of these countries now have well-organized departments of agriculture, and all appropriate more or less money annually for agricultural educational purposes. The place taken by a country in the family of nations with respect to its state of prosperity and its enlightenment and civilization may well be indicated by its annual appropriation for agricultural advancement and education.

It is generally conceded that of the money annually expended by the different governments of the world for various purposes, the appropriations for agricultural education are their best investments—bread cast upon the waters, as it were.

Just how soon the bread "returns" or how large a profit accrues from these investments depends largely upon those upon whom devolves the expenditure of the annual appropriations. The failure to direct the money into the right channels is not only a waste of the sums immediately involved, but nearly always it is followed by additional useless expenditures. This is the visible and, to the layman, the most conspicuous loss. The more serious consequences are loss of time and the arrest of progress.

In order that the agricultural appropriations may yield the greatest possible service to the public in the widest sense of the word, those who parcel out the sums for the various projects and investigations should have a keen perception of the relative value of these projects to the country at large and to its agricultural industries. They must also have insight to select efficient lieutenants who in turn are capable of directing and prosecuting the individual problems of agricultural research.

In accepting a position in a far country where the pressing problems of the day differ greatly from those of his former home, it behooves the investigator to cast aside his pet projects, whatever they may be, and devote himself to solving the problems that are of the greatest public concern in his new environment. Failure to do so may be justly censured. Nor is this all. The new college graduate, and sometimes even older men, when they arrive in the Tropics, are too frequently inclined to regard with disdain and sneers the agricultural methods in vogue there. It is true that many, perhaps most, practices are extremely crude and frequently the practitioner would be unable to explain the wherefore except with a "custom of the country." Yet it is well for the unseasoned to remember that many of these customs have become established through the accumulated experience of many generations, and sifted down, the underlying basis for a certain practice is frequently found to be sound and rational—and as frequently can it usually be improved upon by the intelligent man with technical education when it is "turned over," so to speak, and studied. Here is where ultimately technical agricultural education scores over the ignorant and illiterate, where the public expenditure for the uplift of the agricultural classes becomes justified, and where it becomes a great factor in elevating the general prosperity of a nation.

BUREAU OF AGRICULTURE CIRCULAR NO. 23—THE LOCUST PEST.

[CIRCULAR No. 23. Manila, July 31, 1913.]

THE LOCUST PEST.

By CHAS. R. JONES, *Entomologist*, and D. B. MACKIE, *Assistant Entomologist.*

The most troublesome and destructive pest to the agricultural interests of the Philippines as well as many other countries is the migratory locust. In the Philippines we have at least three, if not five, distinct species of this pest, and there are other species of the family Acrididæ which assume the migratory habit when conditions are favorable. From general appearance the "loctones," or young, of all species are very nearly alike, varying only in minor detail and coloration. These insects under favorable conditions develop unmolested in wild uncultivated lands, such as cogon fields—so common in these Islands—where they may remain for several generations. Sooner or later the adult insects assemble and descend upon the fertile cultivated areas in search of food or new breeding grounds. At first the migrations or flights are short, but in the course of time these swarms may traverse several hundred kilometers; thus not only the adjacent districts but those remote from the breeding areas suffer depredations from this pest.

Due to the fact that there is considerable variation in the time of hatching and consequently in the time of maturity, egg laying does not occur simultaneously with all the females of a given swarm. The oldest females stop and oviposit before the younger are mature, hence, while the locust swarm is constantly on the move, the egg deposits from a single swarm are spread over a vast amount of territory.

In the immense uninhabited cogon areas in various parts of these Islands, this pest develops unmolested, the adult insects eventually migrating to cultivated lands and causing great losses by devastating staple crops such as maize, rice, and sugar cane, likewise seriously injuring coconut palms and bamboo, and at times completely defoliating and breaking the stems and branches of the latter by the great weight of the masses of individuals alighted thereupon. With these prevailing conditions, in order to obtain the desired results, it is necessary that the inhabitants of these Islands be fully informed regarding the habits of this pest, and remedial measures therefor, so that they may fully realize the importance of coöperation.

The average incubation period of the eggs, as shown by experiments, is from eighteen to twenty days, with a minimum of seventeen and a maximum of twenty-three and one-half; in cases of extreme drought, it is possible that a month might pass between oviposition and the emergence of the young locusts.

The young nymphs, or loctones, closely resemble the adult, except that they are wingless and have disproportionally large heads. Within a few hours after emerging from the egg mass the young hoppers display ravenous appetites, eating almost every kind of green herbage within their reach. Sweet potatoes, tobacco, beans, and mongo suffer little or no damage. Hard substances, such as stalks of maize, sugar cane, and stems of shrubs, usually escape destruction, though buri and coconut leaves are not exempt from the attacks of the "voladores," or adults.

The hoppers do not feed as much at night as do the adults, but usually "go to roost" at dusk, clinging to stems of grass or plants.

The nymphs are very active during the warm part of the day. The migratory instinct is early in evidence and the young insects begin to move in a definite direction after the first day or two At first only a few meters per day may be covered, but when they are ready to molt the last time, 3 or 4 kilometers per day may be traversed.

The average time required for the nymphs to reach maturity is about fifty-four days.

When all the hoppers in a swarm have acquired wings they usually remain a few days flying promiscuously about in the immediate vicinity of their previous operations. After a few short local flights, the migratory instinct asserts itself, and the entire swarm mounts into the air and proceeds (usually with the wind) at the rate of about 30 kilometers per day to a new breeding ground. Little is known of the exact conditions influencing the direction and extent of the flight of these swarms. Occasionally a swarm retraces its flight several times before becoming satisfied with a site for egg laying.

The adult locust is very active and readily takes flight at the slightest alarm. A distinct odor is given off by the mature insects and the presence of a swarm may be detected at a distance of several kilometers. The hoppers exhale a similar effluvium, but to a lesser degree than the adults.

Soon after mating the females become heavy with eggs; they do not fly with such ease as before and are sluggish. In this state they readily fall a prey to many birds and animals. After oviposition they do not live long, thus in old swarms the males preponderate.

The fact that the female deposits the entire number of her eggs in one cluster is of great importance in the work of locust destruction; unfortunately, however, all the females of a given swarm do not oviposit at the same time or in the same locality.

As evidence of the extreme degree of the gregarious sense of the migratory locust, it is well to mention that, under ordinary conditions, the number of egg clusters varies from 4,000 to 5,000 per square meter. This does not mean, however, that this number of adults could be found in such a space at any given time. From these figures we see that from each square meter of soil surface where oviposition takes place we could have from 200,000 to 300,000 young hoppers. Multiplying these figures by 10,000 we begin to realize the number (2 to 3 billions) that may emerge from 1 hectare of ground.

CONTROL OF THE PEST.

The control of the migratory locust may be studied under two heads: Artificial, which includes all methods of human control, such as spraying, driving into pits, netting, crushing, burning, inoculating, poisoning, etc.; and natural control, which includes all climatic conditions, predaceous insects, birds, animals, and parasites.

The complete destruction of a winged swarm is practically impossible, though under favorable conditions a very large portion may be caught in nets, or, more rarely still, killed by means of a contact spray, such as kerosene. Therefore, the attention of those engaged in locust-destruction work must be directed against the eggs and hoppers.

The destruction of the eggs in cultivated ground is a matter of great importance and, whenever practicable, should be carried out as thoroughly as possible. In fields where locusts have oviposited, plowing the ground is sometimes very effective, but it by no means insures the destruction of all egg clusters. Where a plow with a moldboard is used, a thorough plowing is usually sufficient to bury nearly all egg masses to such a depth that when the hoppers hatch they are unable to make their escape from the earth and are consequently smothered. When the ordinary Filipino plow is used it is necessary to either roll the land directly after plowing or pack it by means of hand mauls. In land where a plow cannot be used, excellent results may be obtained by digging out the eggs by hand and either crushing them or destroying them by the use of boiling water.

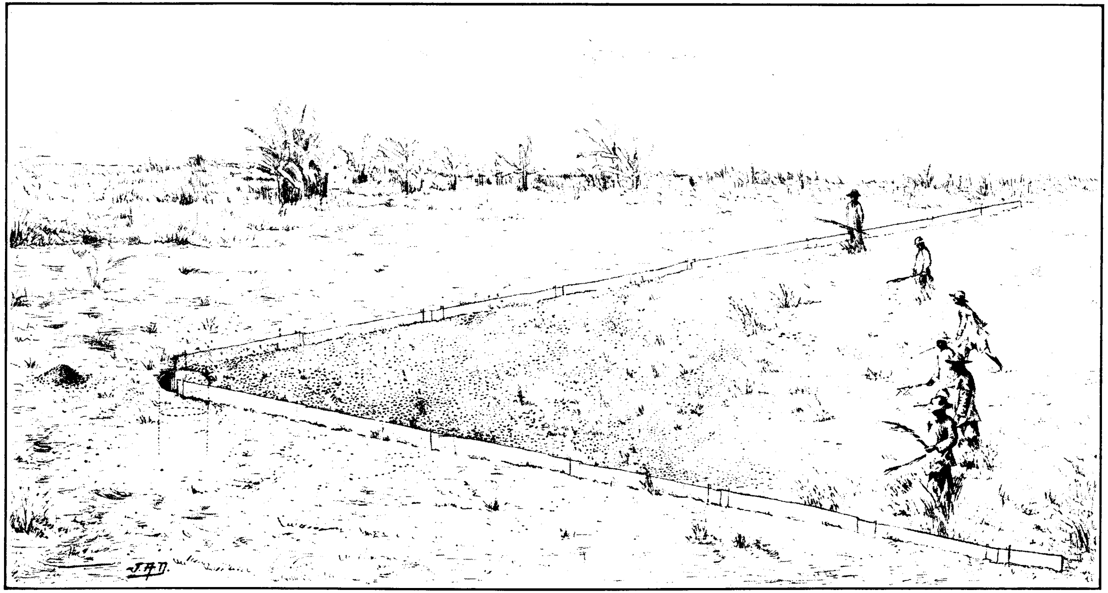
APPROVED METHODS OF HOPPER DESTRUCTION.

Pit, or driving, method.—By far the most important method of combating the young insects is the common pit, or driving, method. While there are conditions under which this method cannot be used with very good results in cultivated ground, it is usually the best to follow. Its application is not only simple, but the Philippine planters in every province have been more or less familiar with this method for many years. In cases where no roofing iron is available earthen dikes faced with sections of banana sheaths constitute a very effective substitute; the leaf blades of the banana should not be used unless the swarm is a small one, because the insects quickly devour the green portion of the leaf.

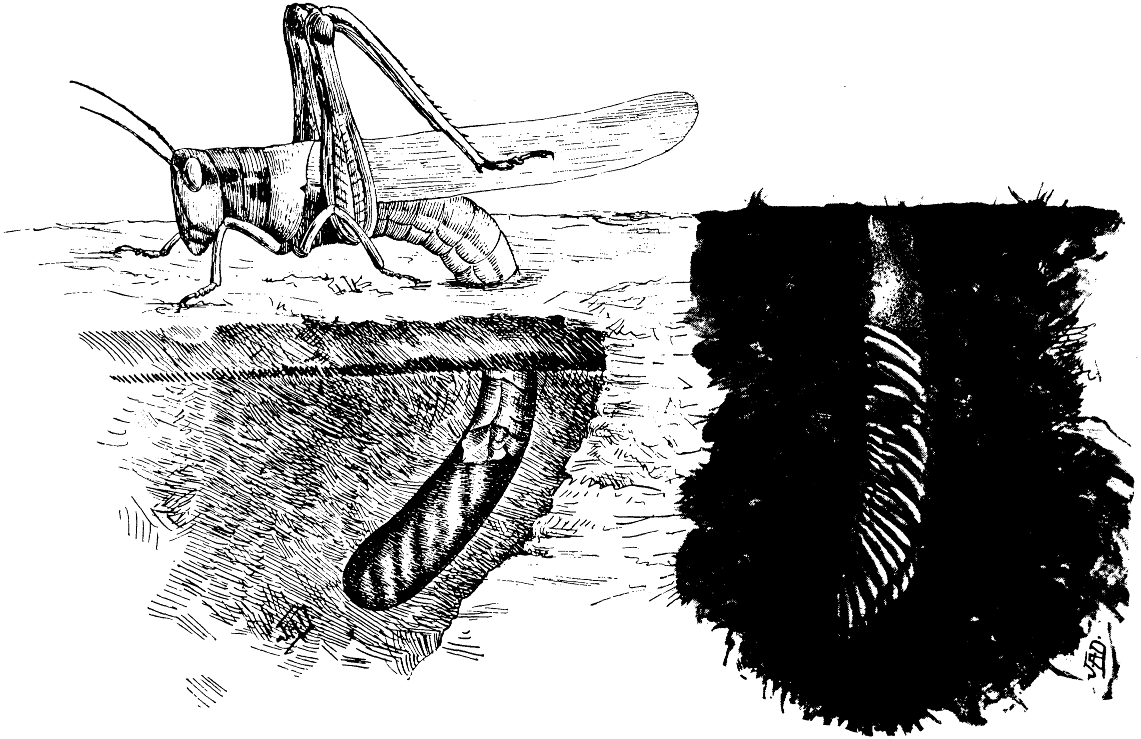
Considerable care should be taken in the construction of these pit fences in order that the loctones may not escape through joints between sheets, and that no brush or grass be left in such a position that the insects can climb over the fence. At the point of the V-shaped structure a pit about 1 meter wide, 1 meter deep, and 1 meter long should be excavated to receive the insects. The upper edge of this pit should be faced with iron sheets, banana-leaf sheaths, or at least banana leaves, to prevent the hoppers from crawling out of the pit.

Generally speaking, the pit fences should be erected a short distance, say 20 meters, in front of the advancing swarm; after both the fence and pit have been constructed, as many men and boys as the size of the swarm may require take their places behind the swarm, and with sticks and branches urge the loctones toward the pit. Inexperienced drivers in their zeal sometimes confuse the hoppers by forcing them to travel too rapidly, and thereby cause the swarm to become a widely straggling mass, whose movements cannot be directed for some time thereafter. Under ordinary circumstances, after the construction of the fence and pit, the entire swarm, if of moderate size, i. e., covering only some 100 square meters or more, should be inside the pit within one hour from the beginning of the drive.

PLATE II.



Showing manner in which corrals and pits should be constructed in pit or driving method of locust destruction.



Migratory locust depositing eggs. and eggs in soil.

The methods of destroying the insects in the pit are of secondary importance, the most common and one of the best being trampling with the feet; covering with earth, or tamping with heavy sticks or mauls, is equally simple and effective.

Nets.—On level ground a large cone-shaped net, or bag, may be used to destroy the young hoppers with considerable success. The side of the net which comes in contact with the earth should be held straight by means of a straight stick; the upper part of the net should, of course, have a piece of rattan or a bow-shaped piece of wood attached to the rim to hold it wide open. In certain cases extra large nets for use with horses (carabaos being too slow) may be used. Both in India and Argentina large nets drawn between trotting bullocks or horses are used with good success.

The insects caught in the bottom or rear portion of the net may be killed either by crushing or by dipping into hot water. The net should be constructed of coarse cloth—either canvas or gunny-sack material.

Nets having a circular frame for keeping the mouth open and mounted on short stiff handles may be used to good advantage in capturing the fliers; even when "roosting" the winged insects may be taken in large numbers by beating these nets against the herbage and shrubbery where the insects have settled.

Rolling.—In young cogon grass on level ground a section of buri-palm trunk, or a straight smooth log, at least 40, and better 60, centimeters in diameter, drawn by carabaos or cattle attached to either end, may be used to crush the loctones with considerable success.

Burning.—Where the young hoppers are hidden in grass and brush on rough ground, it is sometimes feasible to cut the herbage over the infested area and set fire to it as soon as it becomes dry enough to burn. This, of course, will also apply to an area in which it is definitely known locust eggs are about to hatch. As soon as the locusts appear and collect upon the dried grass and brush they may be almost completely destroyed if the material for burning be in fair quantity. The burning method is particularly practicable in the cogonales in uncultivated districts.

Insecticides.—Locusts in any stage of development may be killed either by contact sprays or by poison solutions. The simplest method is perhaps kerosene, or any of the light crude petroleum oils, used as a direct-contact spray. In or near barrios where there are valuable crops it is in many cases practicable to spray the insects with kerosene, using cheap hand pumps, the kerosene being carried in metal buckets or even in the original tins; this may also be used very effectively upon the fliers while "roosting" at night, though it is much more effective on the young loctones.

For general field work, however, the kerosene-spray method cannot be recommended very highly on account of its expensiveness; a modification of this, known as the kerosene-emulsion method, is very much cheaper and may be used very advantageously on young hoppers in open areas. This emulsion is made by mixing kerosene with soap and water to form a dilute mixture or emulsion, the soap holding the kerosene in suspension; even very dilute mixtures are effective against the very young hoppers.

Unfortunately, the use of arsenical poisons is usually attended with serious danger for the following reasons: (1) The Philippine planter is in general unfamiliar with poisons and the methods for using them; (2) there is always more or less danger of poisoning domestic animals through their feeding upon the poisoned grass; (3) many beneficial birds which normally feed upon locusts might be killed by eating the poisoned insects. In special cases, however, such poisons as lead arsenate, Paris green, or a sweetened mixture of white arsenic may be used by experienced persons with very good effect.

The cannibal habits of the locust are of great importance in using arsenical sprays, for as soon as the first insect in the advance of the swarm becomes affected by the poison he is devoured by his companions, which, of course, are also killed by the poison contained in the first body and so on for at least three, if not four, cycles.

COÖPERATION.

The eradication of the locust plague in a given province can be accomplished by systematic and coöperative work. This was demonstrated and proved by the governor of Iloilo in 1910. Failure on the part of some municipal and provincial officials to enforce the provisions embodied in Act 2121 is deplorably common. The principal objection to the said act seems to be that certain officials regard it as a hardship upon the people if compelled to work as prescribed by this law. Thus it may happen that the people of an infested barrio work diligently while those of the central part of the town are not compelled to assist and therefore do not work at all.

In order to bring the work upon the majority of the people each cedula-buying person of any given municipality should be compelled to work while the danger lasts at least one day per week. This will increase the efficiency of the campaign and the swarms of locusts in question can sooner be brought under control.

As a sample case, the following table, compiled from the official reports from infested municipalities, gives the number of persons working and the results accomplished:

Official municipal reports as to the number of infested areas and number of persons working.

Municipality.	Dates inclusive.	Infested sites.	Total people working.	Days worked.	People per day.	People per site.	Total cavans of locusts destroyed.	Cavans destroyed per day.	Average cavans per person.
No. 1	Oct. 15 to Oct. 27	5	137	12	27	2.25	472	39.33	1.4
	Oct. 27 to Nov. 8	16	563	12	35	2.9	530	44.1	1.2
	Nov. 8 to Nov. 20	9	275	12	30	2.5	581	48.4	1.6
No. 2	Oct. 20 to Oct. 31	7	51	10	5	.5	394	39.4	7.8
	Nov. 1 to Nov. 10	16	168	10	17	1.7	663	66.3	3.9
	Nov. 11 to Nov. 20	20	110	10	11	1.1	193	19.3	1.7
	Nov. 21 to Nov. 30	13	94	10	9.4	.94	179	17.9	1.9
No. 3	Nov. 1 to Nov. 10	19	292	10	19.2	1.92	804	80.4	4.2
	Nov. 10 to Nov. 20	23	424	10	42.4	4.24	971	97.1	2.08
	Nov. 20 to Nov. 30	5	69	10	6.9	.69	66	6.6	.9
No. 4	Sept. 21 to Sept. 30	6	228	10	22.8	2.28	261	26.1	1.1
	Oct. 1 to Oct. 10	13	282	10	28	2.8	652	65.2	2.3
	Oct. 11 to Oct. 20	12	520	10	52	5.2	1,525	152.5	2.9
	Nov. 1 to Nov. 10	4	97	10	9.7	.97	1,000	100	1
	Nov. 11 to Nov. 20	8	345	10	34.5	3.45	1,315	131.5	3.8
	Nov. 21 to Nov. 30	1	25	10	2.5	.25	150	15	.6
No. 5	Sept. 28 to Oct. 8	12	514	10	51.4	5.14	96	9.6	.1
	Oct. 8 to Oct. 18	15	382	10	38.2	3.82	199	19.9	.5
	Oct. 18 to Oct. 28	21	532	10	53.2	5.32	240	24	.4
	Oct. 28 to Nov. 8	21	522	10	52.2	5.22	731	73.1	1.4
	Nov. 8 to Nov. 18	16	267	10	26.7	2.67	562	56.2	2.1
No. 6	Sept. 30 to Oct. 9	12	150	10	15	1.5	52	5.2	.4
	Oct. 10 to Oct. 20	4	96	10	9.6	.96	40	4	.04
	Oct. 21 to Oct. 30	5	84	10	8.4	.84	53	5.3	.6
	Nov. 1 to Nov. 10	11	197	10	19.7	1.97	112	11.2	.5
	Nov. 11 to Nov. 20	12	417	10	41.7	4.17	298	29.8	.7

From this it can readily be seen that many of the locust swarms were left to develop more or less unmolested. Taking a general average, at no time did the average maximum number of individuals working per day on any given swarm reach more than 5 persons. The municipalities used in the above example are all second or third class, and have at least 14,000 inhabitants, i. e., at least 3,600 taxpayers or cedula-buying persons. Now, if every person having a cedula were compelled to work one day per week it would mean 14,400 day laborers per month, which would give 480 laborers per day; taking the general average of 12 infested areas per municipality, 40 persons would be available where this table shows only from 1 to 5.

Act 2121 provides that all able-bodied inhabitants—with few exceptions—of the Philippines shall work in locust destruction when the pest occurs. All these cannot be reached or a check kept on them, but the maximum number of persons can be obtained by proper municipal organization, as follows:

1. Oblige all taxpaying persons to work one day each week.
2. Divide the municipality into districts.
3. Assign certain days to certain members of the municipal council or lieutenants of barrios to record the number of the cedulas of persons working.
4. Fine all persons whose cedula numbers do not appear upon the roll four times per month, in accordance with paragraph 6 of the revised locust resolutions. Deposit all locust fines collected in a special fund for locust work.
5. Pay all persons whose cedula numbers appear more than the required number of times a small daily wage from the said fines fund.

THE TOBACCO CATERPILLAR (*Prodenia litura* Fabr.).

By CHARLES R. JONES, *Entomologist.*

Tobacco is one of the staple crops of the Philippine Islands and though the output at present is slightly less than in former years it still stands near the head of the list of Philippine products. The principal tobacco-growing district is in northern Luzon in the Provinces of Cagayan and Isabela, although it is produced to a greater or less extent throughout the Archipelago. In these provinces considerable damage is done by insect pests.

The greatest pest in these sections is *Prodenia litura* Fabr., belonging to the order Lepidoptera, family Noctuidæ. The larva of this moth attacks growing tobacco, both young and old, but the greater damage is done to the young leaves, since even a small hole made in the bud or growing leaf assumes considerable proportions as the leaf develops.

The pest is also present to a greater or less extent in various districts where tobacco is not cultivated, and, since it frequently attacks the various garden and field products, remedial measures are worthy of consideration. It is therefore the object of this paper to give remedial measures and to acquaint the planters with the habits and life history of this pest.

CLASSIFICATION AND SYNONYMY.

This insect belongs to the family Noctuidæ, subfamily Trifinæ, and was first described by Fabricius in 1775 as *Noctua litura.* There is a great variation in the color markings of the adult, hence this insect has been at various times described as a new species, and therefore it has an extended synonymy. Hampson in his Fauna of British India, Moths (1894), designates this species as *Prodenia littoralis,* but later in his Catalog of Lepidoptera Phalænæ (1909) he establishes it as *Prodenia litura* and gives the following synonymy:

Noctua litura Fabr., Syst. Ent. (1775), 601.
Noctua histrioniæ Fabr., Syst. Ent. (1775), 612.
Noctua elata Fabr., Spec. Ins. (1781), 2, 220.

Hadena littoralis Boisd., Fauna Ent. Mad. (1833), 91, pl. 13, fig. 8; Moore, Lep. Ceyl. (1887), **3**, 19, pl. 146, figs. 1 *a*, *b;* Hamps., Fauna Br. Ind., Moths (1894), **2**, 247; Staud., Cat. Lep. pal. 184.
Hadena retina Frr., Neuebeitr (1846), 5, 161, pl. 474, figs. 2–3; Herr.-Schaff., Eur. Schmitt. Noct., figs. 144–145.
Prodenia tasmanica Guen., Noct. (1852), **1**, 163.
Prodenia ciligera Guen., Noct. (1852), **1**, 164.
Prodenia tastaceoides Guen., Noct. (1852), **1**, 165.
Prodenia subterminalis Wlk. (1856), **9**, 196.
Prodenia glaucistriga Wlk. (1856), **9**, 197.
Prodenia declinata Wlk. (1857), **11**, 723.
Manusctra albisparsa Wlk., Journ. Linn. Soc. Zool. (1862), **6**, 186.
Prodenia evanescens Butl., Men. Nat. Ac. Sci. Wash. Rep. Eclipse. Exp. (1884), 94.
Prodenia litura Fabr. (Hamps.), Cat. Lep. Phalænæ (1909), **7**, 245.

HISTORY AND DISTRIBUTION.

This insect has an extended range as its habitat, Swinhoe[1] giving Australia, Borneo, India, and the Philippines as localities from which it has been recorded, while Hampson[2] has a larger scope including all South Sea Islands, New Guinea, Australia, Malay Archipelago, India as far as Sekhim, Sunda Islands, Japan, China, Turkey, Syria, Africa (from Uganda, Natal, Mashonaland, and Mauritius), and Lefroy[3] states it is common throughout India and occurs in the Himalaya and Nilgiri Mountains as well as the plain districts.

OCCURRENCE AND FOOD HABITS.

This pest has frequently been reported to this office from the Visayan Islands as damaging corn, and specimens have been received from the Province of La Union where it was reported as doing considerable damage to tobacco. It occurs also throughout the Cagayan Valley, especially in the tobacco fields from Lal-loc to San Luis. It is known throughout that district as the "camarin worm" and it is generally believed to develop in the camarines, or sheds, *in a single night,* when in reality it develops in the field and is gathered with the tobacco leaves and taken into these storehouses. When the tobacco wilts these "worms" leave it and search for more suitable food; it is then that they are discovered by the planters.

The larvæ of this insect can be found in their various stages at almost any time where the castor plant occurs, being particularly fond of the tender succulent leaves of that plant. In fact, they are such general feeders that they will eat almost any kind of green vegetation. The writer has found them feeding upon the following plants:

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[1] Catalog of Eastern Lepidoptera-Hetorocera.

[2] Cat. Lep. Phalænæ (1909), 7, 246.

[3] Memoirs of the Department of Agriculture in India (1908), II, No. 5, 79–93, pl. 1.

Tomato, attacking both the leaves and fruit.
Tobacco, feeding upon the leaves.
Calaboa (*Monochoria hastata*), feeding on the leaves.
Maize, feeding upon the leaves of small plants.
Cabbage, the leaves.
Rice, eating the leaves.
Sweet potato, feeding upon the leaves.
Castor (*Ricinus communis*), feeds upon the leaves.
Jimson-weed (*Datura* sp.), feeds upon the leaves.

To this may be added the food plants recorded by Lefroy[1] of India:

Lucerne (*Medicago sativa*), abundant on irrigated lands.
Jute (*Corchorus capsularis* and *C. olitorius*), feeds upon the succulent apical shoots.
Indigo, noted in August but not especially serious.
Potato, cutting off young plants.
Mulberry (*Morus alba*), eating the leaves.
Pakur (*Ficus infectoria*), eats the leaves.
Maruá (*Eleusine coracana*), scarce.
Ground nut (*Arachis hypogæa*), feeds upon the leaves.
Urid (*Phaseolus radiatus*), occasionally.
Tur (*Cajanus indicus*), feeds on leaves and pods.
Sugar cane (*Saccharum officinarum*), feeds on the leaves.
Agathy (*Sesbania ægyptiaca*), feeds on the leaves.
Coleus, found occasionally in gardens.
Dhaincha (*Sesbania aculeata*), feeds on the leaves.

The adults seem to be not at all particular in selecting host plants for oviposition, but lay their eggs on whatever species is convenient, and the larvæ seem to thrive on whatever food is at hand.

LIFE HISTORY.

Eggs.—The eggs of this moth are laid in clusters (fig. 1, *a*) on either the top or bottom of the leaf, the greatest number of clusters having been noted on the top of the leaf. The clusters of eggs vary in number from 35 to 500 eggs. They are arranged in rows and the mass generally contains three layers, the whole egg mass being covered with short buff-colored hairs that are obtained from the anal tuft of the moth. This hairy covering undoubtedly acts as a protection against parasites.

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[1] Memoirs of the Department of Agriculture of India, 1908, 11, No. 5; 91–92.

The egg is rounded and ridged, pearly white when freshly laid, growing darker as it stands; the shell is rather tough and not easily broken; average period of incubation three days. There is considerable uniformity in the time of hatching of the eggs in each mass.

Larva.—The newly hatched larva averages 1 millimeter in length and is greenish in color; body cylindrical. When disturbed it curls up like a cutworm and suspends itself from the plant by a tiny silken thread. The larvæ feed upon the epidermis of the leaf working from the under side and sometimes completely skeletonizing it; they keep close together in masses for three to five days. Plate IV, *a*, shows the appearance of castor leaves attacked by young larvæ of this species; tobacco leaves have about the same appearance, but are not skeletonized to such an extent, as the leaf tissue is of a thicker texture. In feeding thus, in masses, the bodies of the larvæ are generally parallel with the heads all pointing in one direction (Pl. IV, *b*).

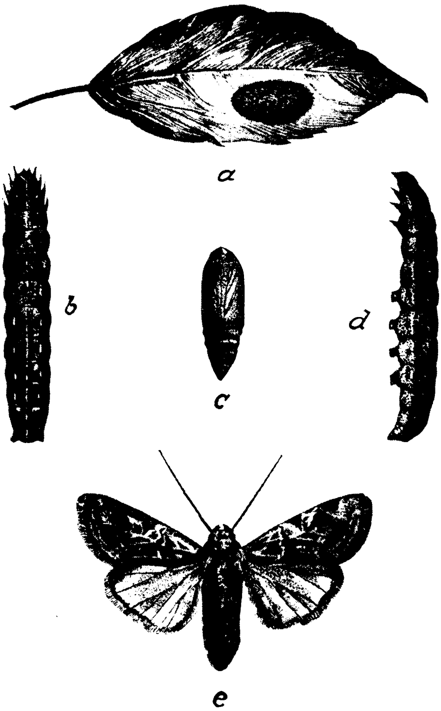
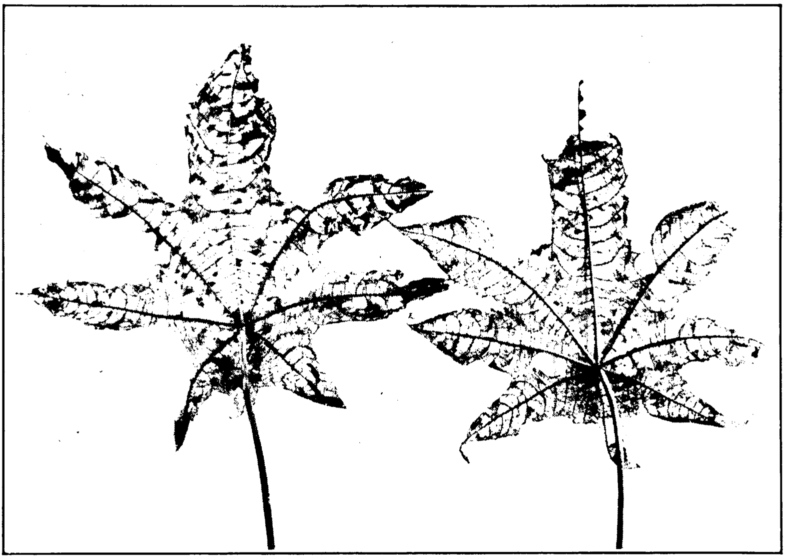
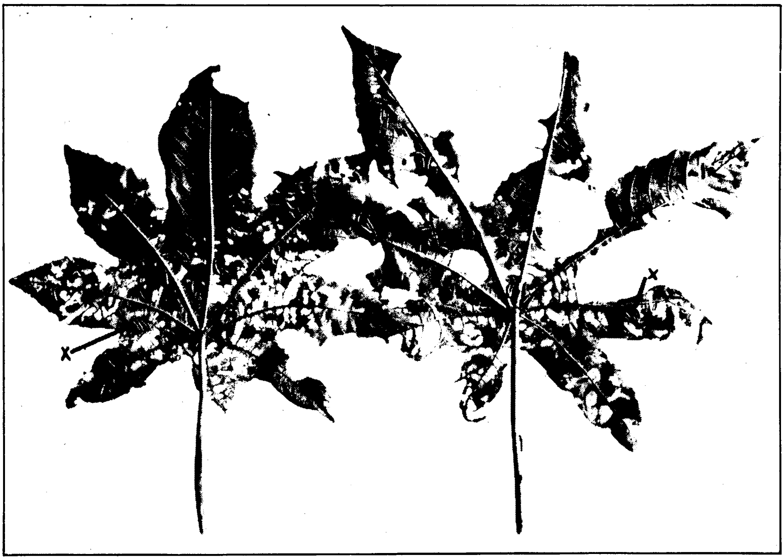


FIG. 1. *Prodenia Litura* Fabr. *a*, egg cluster on leaf; *b*, larva, dorsal view; *c*, larva, lateral view; *d*, pupa, ventral view; *e*, adult.



(*a*) Skeletonized castor (Ricinsus communis) leaf, caused by feeding of the tobacco-caterpillar larva.



(*b*) Showing young larvæ of the tobacco caterpillar; when first taken the larvæ were all side by side as at X. Upon the leaf tissue wilting, the larvæ have begun to wander about.

The first molt occurs in about two to four days after hatching, and the second about three days after the first. The coloration changes are considerable and the dark transverse band of the first abdominal segment becomes very pronounced. If food is still abundant the larvæ remain in masses or small groups, otherwise they begin to scatter. After the third molt they become very active and move about freely. They now consume the entire tissue of the leaf and do not confine themselves to the epidermis as in the first three stages.

During the process of development this caterpillar passes through five instars. The full-grown larva (fig. 1, *b*, *c*) may be easily recognized from the following description:

> Head smaller than following segment, bilobed, black, slightly hairy, cervical plate triangular, bordered with white. Antennæ and cheeks pale yellow; ocelli, mandibles, and maxillæ brown. Body cylindrical, bearing five pairs of functional prolegs; ground color brownish-black, tinged with orange, varying considerably among individuals. First thoracic segment with a dark spot laterally, just above first pair of legs, bearing two hairs each. Second and third thoracic segments with two bright-yellow spots. Three yellowish spots dorso-medial, in some cases displaced by a line; two light-brownish lateral lines one above and one below spiracles; above the top line is a broken line composed of velvety, semicrescent patches, varying among individuals. Spiracles orange. Feet black, prolegs brownish, gradually fading into orange, in some cases the brown leaving off abruptly. Anal plate brownish with orange dot at base. Length 4.5 centimeters, width 5 millimeters.

When full-grown and ready to pupate the larva crawls down the plant, enters the soil to a distance of about 7 or 8 centimeters, and forms an earthen cell wherein it transforms to the pupa and adult. The average duration of the larval stage as observed is 17.2 days.

The pupal cell averages 22.5 millimeters in length and 9.28 millimeters in width.

Pupa.—The pupa (fig. 1, *d*) is of the general noctuid type: Elliptical; surface shiny, dark reddish-brown; head rounded, smooth, antenna-case rather prominent; abdomen with three movable incisures; spiracles very dark in center; cremaster composed of two prolonged spines curved inwardly, light at tips, almost invariably entangled in last larval molt; wing-covering darker than rest of the body; average length of pupa without cremaster, 18.9 millimeters. Average duration of pupal stage is 9.6 days.

Adult.—The adult (fig. 1, *c*) of this insect remains very quiet during the daytime and usually conceals itself in darkened places. It rests with the wings held closely in to the body; when disturbed it flies quickly with a zigzag movement. During the night the moths fly about and feed on nectar of flowers. Oviposition occurs early in the evening and at night. In the laboratory they were noted to live from four to eight days when fed on sweetened water, but the length of life is undoubtedly longer under natural conditions. Copulation occurs soon after emergence. Egg laying commences two to three days after emergence. They deposit their eggs in clusters as before described, and as few as 35 eggs have been noted in a cluster. The general average number per mass is between 200 and 350 eggs. Some individuals were noted to lay five different clusters with a total of 518 eggs.

The following table gives the life cycle as worked out in the laboratory at Manila:

Table showing life cycle of Prodenia litura Fabr.

Observation No.	Individuals observed.	Eggs.			Larvæ.		
		Laid.	Hatched.	Days.	Hatched.	Pupated.	Days.
1	7	Mar. 6	Mar. 9	3	Mar. 9	Mar. 27	18
2	2	do	do	3	do	do	18
3	3	Mar. 7	Mar. 10	3	Mar. 10	do	17
4	2	do	do	3	do	Mar. 28	18
5	3	Mar. 8	do	2	do	Mar. 26	16
6	2	do	do	2	do	Mar. 28	18
7	1	do	Mar. 11	3	Mar. 11	do	17
8	3	Apr. 9	Apr. 11	2	Apr. 11	Apr. 30	19
9	2	do	do	2	do	do	19
10	5	Oct. 13	Oct. 16	3	Oct. 16	Oct. 28	12
Average				2.6			17.2

Observation No.	Pupæ.			Adult.			Total life cycle.
	Pupated.	Emerged.	Days.	Emerged.	Died.	Days.	
1	Mar. 27	Apr. 5	9	Apr. 5	Apr. 10	5	35
2	do	Apr. 6	10	Apr. 6	Apr. 14	8	39
3	do	do	10	do	Apr. 10	4	34
4	Mar. 28	Apr. 7	10	Apr. 7	Apr. 11-12	4-5	35.5
5	Mar. 26	Apr. 7-8	10-11	Apr. 7-8	Apr. 10-12	3-4	32
6	Mar. 28	Apr. 9-10	12-13	Apr. 9-10	Apr. 13-14	4	36.5
7	do	Apr. 8	11	Apr. 8	Apr. 12	4	35
8	Apr. 30	May 6	7	May 6			
9	do	May 7	8	May 7			
10	Oct. 28	Nov. 5	8	Nov. 5			
Average			9.6			4.7	35.5

CONTROL.

Parasites and predaceous enemies play an important part in the natural control of this pest. Although the eggs are fairly well protected by their hairy covering, two small hymenopterous parasites have been bred therefrom in large numbers. A large Tachinid fly has also been bred from the larvæ and a large black mud-dauber wasp was observed several times carrying off the larvæ.

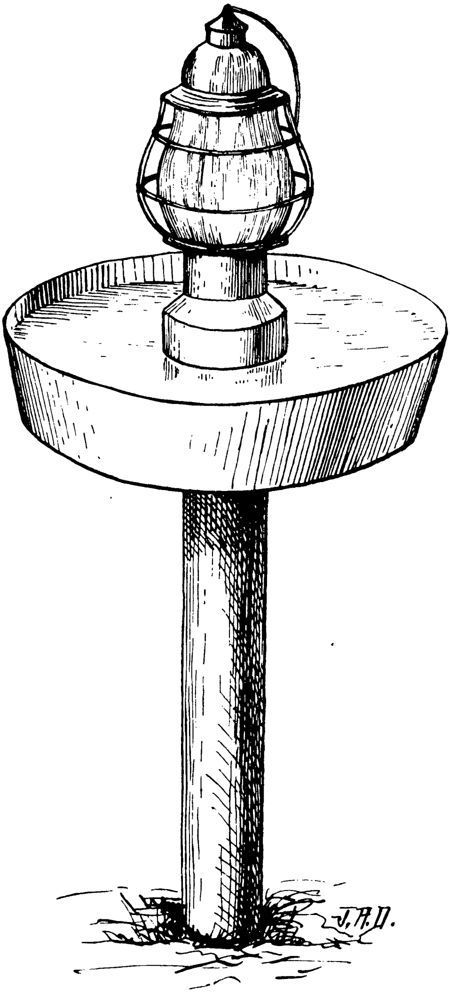


FIG. 2. Light trap, used for catching adults of the tobacco caterpillar. The basin under the light is filled with water and a small quantity of kerosene.

Birds also play an important part in the natural control of this pest, but to what extent has not been definitely determined.

When these larvæ appear in numbers sufficient to warrant it, they may be controlled by an application of Paris green or arsenate of lead. The latter is preferable, as it does not have the burning qualities of the former and may be applied at a more concentrated strength without any ill effects to the plant.

After the planter becomes familiar with the habits of this pest, and if it does not appear in too great numbers, he can easily prevent damage to his crop by hand picking; the deposition of eggs in masses and the social habit of the larvæ facilitate this method. Observations should be made at various intervals of the growing crop to ascertain whether or not this pest is present, and if so, active measures should be commenced at once. The moths are attracted to lights and may be trapped by placing lights over basins of water and kerosene (fig. 2) in various parts of the field. The moths that fly to these traps will fall into the water and oil and be killed.

THE BUREAU OF AGRICULTURE BANANA COLLECTION.

By O. W. BARRETT, *Chief, Division of Horticulture.*

Everything considered, there is probably no more important fruit in the whole realm of horticulture than the banana. It is certainly the most widely known of all the fruits, and is one of the most nutritious, one of the most productive, and one of the most easily cultivated fruits of any clime or country. Unfortunately, the bananas and plantains of the world have never been carefully studied, however, with the object of determining which varieties are best for home use, which for commercial export, and which for manufactured products ("figs," flour, "coffee," chips, etc.) ; neither have they been studied with a view of working out the synonymy of the varieties. This is a curious fact, considering the length of time during which banana collections, more or less limited to be sure, have been under observation in the various tropical stations in the colonial dependencies of European nations.

One reason, however, which may partially account for the neglect of this class of fruits is the fact that very few of the cultivated sorts produce viable seeds, while the suckers, or offsets of the parent stem, require expert handling in order to be transported successfully over long distances. It is now quite certain, however, that there are at least two possible methods of sending banana roots over practically any distance—for instance, from Porto Rico to the Philippines: The Wardian-case method of transporting small living plants in a ventilated glass-covered shipping box; and the dried-root method of packing the "cured" bulb-like base of the sucker in a ventilated package of *mailable* size.

About eighteen months ago the Bureau of Agriculture formed a definite plan for banana-investigation work and at the beginning of the last fiscal year a small sum of money was set aside under a special project for the furtherance of this idea. Without making a special effort during the first half of the last fiscal year (July to December, 1912) a remarkably large number of indigenous Philippine varieties was assembled and planted out at the Alabang stock farm. During the latter half of that year a more systematized effort was made toward getting banana varieties from neighboring foreign countries to be tested alongside the Philippine collection; and recently letters have been sent out to the presumably favorable districts of the Archipelago requesting the municipal presidents of those districts to furnish the Bureau a list of the varieties grown in their neighborhoods, and to send one root each of all varieties which in their opinion were not to be found in the vicinity of Manila. Letters were also sent to several of the neighboring foreign countries requesting assistance in this line of work, with the idea of exchanging first-class Philippine sorts for the varieties obtainable in those countries.

Both these methods of arousing interest in the Bureau's collection are giving every assurance of success and already a very considerable number of interesting varieties have been added to the list.

There is no question but that the banana industry should be a profitable one here in the Philippines. The plants grow well unless troubled by unusually severe droughts and typhoons; there are practically no severe insect pests, the leaf-roller butterfly and the root-grub weevil being the only ones known at present worthy of consideration. Two years ago a banana disease was discovered which, it was feared, might cause severe losses in plantations, but this trouble no longer causes anxiety since it appears that most varieties, except the Dwarf or Chinese, are resistant to this disease, and besides the few outbreaks which have been noted have practically disappeared without expensive measures being employed to combat them.

On the other hand, the demand for good market bananas is constant and strong. The price of an ordinary bunch of bananas in the Manila market is about three times what it should be, considering the price at which these fruits are sold in other tropical countries. Furthermore, the assortment of varieties to be had in any given locality of the Archipelago is deplorably meager; where there should be always in evidence not less than twenty-five varieties to meet the various requirements, such as fresh fruit to be eaten "out of hand," sorts for boiling, baking, and frying, we usually find here but five or six kinds and these the *easiest to grow* instead of the *best to eat*. In order to know just what sorts should be propagated on a large scale for distribution, it is necessary that comparative tests be made including as many native and introduced varieties as possible; and, by the same token, it is practically impossible, without spending a great deal of time and money in traveling, to say definitely just what are the synonyms of any given variety. For instance, it may be probable that the Tindoc, Todoc, and Tumoc are one and the same variety of plátano, having different names in several provinces, but it is a more difficult matter, before a comparative fruiting test is made, to say whether the Bongoyan, the Bangalan, the Bangaan, and the Bungolong are all dialectal variations of the same varietal name. On the other hand, it has already become clear in the course of this work on the present collection that there are several distinct sorts of Lacatan, several of Sabá, and several, also, of Morado, although it appears that very few Filipino planters or market vendors recognize the real variational differences.

A monograph of the bananas has recently appeared; but having been made, apparently, without a large, not to say complete, collection of fruiting specimens in evidence for comparison, it follows that the descriptions and general classification of the group are necessarily of but little use to the musologist of the future. It is of great interest to note that several species—probably not less than ten—of the genus *Musa* are native to the Philippine Archipelago and quite possibly several of these have never been described by botanists.

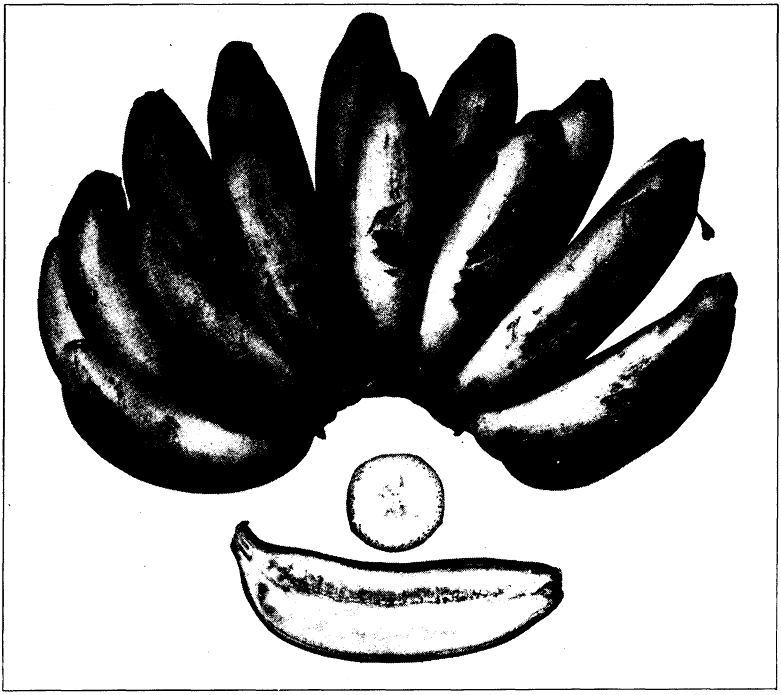
Though there is some variance of opinion among phytogeographers as to the origin of bananas, the consensus is very strongly in favor of the Indo-Malayan region as the home of at least a large part of the Musas. Tropical Africa contains a great number of wild and semicultivated species and varieties besides a considerable number of cultivated sorts which very evidently have been introduced from the Indo-Malayan region. It is practically certain, however, that a few varieties, at least, of bananas and plantains were existent in the New World before the arrival of Columbus. Throughout the entire Malay Peninsula, Assam, and the back districts of Siam and Indo-China, there are probably a large number of little-known species and varieties of wild and semicultivated sorts. Some of these were undoubtedly the parents, so to speak, of the varieties now under cultivation throughout the Tropics. The archipelagos of the Pacific are also the habitat of certain types not found to any extent outside of that area; for instance, the Fehi type, which bears the fruit bunch upright above the plant stem, does not occur, so far as we know, in the Philippine Archipelago or Malaya and is believed to be found in only one or two small districts in the Hawaiian Archipelago.

Several of the groups of islands in the Pacific formerly possessed a rather large indigenous banana flora and the natives of those islands were dependent to a great extent upon those varieties for food previous to the arrival of the white planters. Upon the opening up of sugar plantations in the lowland valleys, the demand for laborers and the exigencies of civilizing processes practically forced the inhabitants of the island interiors down to the coastal plains, thus leaving the original banana plantations and gardens largely at the mercy of rampant jungle vegetations as well as exposed to the depredations of wild pigs, cattle, etc. Thus, in the larger islands where fifty years ago it would have been easy to collect within a few days 25 to 50 varieties of edible bananas and plantains, to-day the assembling of even half that number in the same locality might require several weeks' hard work. It is even probable that some very interesting and practically unique types have been utterly lost to horticulture on account of this fact.

It seems, then, that as all the other tropical countries have neglected this important piece of horticultural investigation, it now behooves the Philippine Bureau of Agriculture to make earnest effort to carry to a practical conclusion these two lines of study: The trying out of presumably commercially profitable varieties from the planters' standpoint, and the working out of the question of synonyms, or name duplication, of the principal varieties obtainable with a reasonable amount of time and expense. It will never be possible, perhaps, to collect all the 250 to 350 kinds of bananas in one experimental plantation, but if the planters, horticulturists, and botanists of the Tropics will lend their assistance we shall soon have a collection of these fruits as the basis of accurate information which will be a landmark in the history of tropical horticulture. In fact, it is practically certain that never before have there been brought together so many varieties as are already in evidence at the Alabang stock farm and the Singalong experiment station.

The following varieties of Philippine bananas and "plátanos" have been numbered and placed in the trial grounds for study:

Agotay.
Alinsanag.
Amas.
Angao.
Asluman or Latundan.
Balangun.
Banegas.
Bangaan.
Bangalan.
Binangay.
Binaoy.
Binasaya.
Binato.
Binuli.
Bocnec.



Standard arrangement, "Cariñosa" banana; showing a typical "hand" and the cross and longitudinal sections of fruit.

Banana roots, showing proper method of packing; received from Porto Rico (seven weeks in transit) in good condition.

Bongoyan.
Bongoyan de dos Racimos.
Boracho.
Bugtong.
Bululan.
Bungan.
Bungolong.
Bungulun.
But-uhan.
Cababa.
Calailay.
Calalay.
Calitan.
Canara.
Canaya.
Candaba.
Canipa.
Cantong.
Carandan.
Carao.
Cardava.
Cariñosa.
Carnaba.
Catep.
Colicot.
Consing.
Cuposa.
Daliao.
Daliring-guinoo.
Darian.
Doca.
Dojoy.
Dool.
Dulol.
Eda-an.
Enetlog.
Enosa.
Famotien.
Finipita.
Fob-olo señora.
Galamay señora.
Galayan.
Gapis.
Ginaring.
Gouyod.
Guinauit.
Gulian.
Guyod.
Guyud.
Higos.
Igos.
Inabaniko.
Inambac.
Inatip.
Ipod.
Inog-og.
Kaalii.
Kadisnom.
Kanala.
Kilan palna.
Kinamay dalaga.
Kinaoit.
Kinayagan.
Lacatan.
Lapnao.
Latundan.
Latundan, or Asluman.
Lawit.
Lisohan.
Litondon.
Longsing.
Maching.
Malbaga, or Manubaga.
Mangamas.
Masecampo.
Matabia.
Maybay.
Mayoco.
Moco.
Morado.
Mundo.
Naglihim.
Pagoja.
Palapaynon.
Pamoti-on.
Panono.
Paquel.
Pelipita.
Pinaghabilinan.
Pitogo.
Plátano.
Plátano (large).
Plátano (small).
Poriquit.
Principe.
Putian.
Raines-na-pula.
Raines-na-puti.
Retundol.
Sabá.
Saba Iloco.
Sabang-Castila.
Saba-Obispo.
Saksik.
Saba-Mariana.
Salebaguio.
Silangan.
Siñangil.
Soybaguio.
Sulay Baguio.
Taisok.
Talipa.
Tampihan.
Tanbunan.
Tancoñgon.
Tarusari.
Taub.
Tenombaga.
Tinalisay.
Tindoc.
Tinombaga.
Todoc.
Tomoc.
Tucon.
Tudlo-dalaga.
Tudlug-dato.
Tumbaga.
Tumoc.
Tundan.
Tundoc.
Tunsing.
Veinticohol.
Virgen.
Unidentified (11).

There are unquestionably a considerable number of synonyms in the above 159 "numbers," but until the plants have fruited in the side-by-side trying-out field the Bureau does not feel warranted in "cutting out" any of the above names. However, information is solicited from planters throughout the Philippines regarding the identity of certain names, and it is hoped much good will result if free criticisms of this list are handed in to the Bureau. For instance, if practically all of the criticising Filipino farmers should assure us that Sulay Baguio (Leyte name) is identical with Salebaguio (Oriental Negros name), we shall be able to "kill" one of the numbers on our cards; while if some observant planter can assure us that the Malbaga (Cebu name) is not quite the same as the Manubaga, we will endeavor to prove his statement by fruiting a plant or two of each variety in close proximity.

The following 22 supposedly distinct botanical species of *Musa* have been assembled for a comparative test.

M. alba indica.
M. arnoldi.
M. corniculata.
M. chinensis.
M. gilleti.
M. hybrida.
M. japonica.
M. livistoniana.
M. livingstonia vera.
M. martini.
M. superba.
M. ensete.
M. manni.
M. rosacea.
M. sapientum.
M. sapientum var.
M. ornata rosea.
M. rhodoclamys.
M. religiosa.
M. sumatrana.
M. cocinnea.
M. Cavendishii.

The above list could undoubtedly be greatly increased, but since space for the banana tests is already in danger of being overcrowded, the scientific side of this question must be given second place.

While exchange of economic plant material between the Bureau and foreign stations has not proceeded so far as it should have, the following 95 economic varieties have been brought in from outside, and it is believed that nearly all of these sorts will prove to be distinct from those indigenous to the Philippines.

- Australia:
  - Barrego.
  - Butter.
  - Delena.
  - Moku.
  - New Guinea sugar.
- Federated Malay States:
  - Changi Putri.
  - Manka.
- Ogasawara Islands (Japan):
  - Champa.
  - Unidentified (2).
- Hawaii:
  - Aeae.
  - Brazilian.
  - Eleele.
- Hawaii—Continued.
  - Hamakua.
  - Hua Moa.
  - Iholena.
  - Maia Maoti.
  - Manaiula.
  - Popoulu.
- Hongkong: Coolie.
- India:
  - Boodu Bale.
  - Champa.
  - Chatim.
  - China Champa.
  - China Champa (small).
  - De Moira.
  - Hazara.

- India—Continued.
  - Kabuli.
  - Kanaibansi.
  - Kanchkela.
  - Karanjalee.
  - Kari Bale.
  - Katali.
  - Lal Velchi.
  - Maduranga.
  - Martaban.
  - Martaban Dacca.
  - Mhaskel.
  - Moulmein.
  - Muthali S. Kaukan.
  - Pacha Bale.
  - Ramkela.
  - Rasa Bale.
  - Singapur.
  - Sughanda Bale.
  - Yale Bale.
- Porto Rico:
  - Guaran.
  - Hardong.
  - Kongo Blanco.
  - Kongo Colorado.
  - Lady Finger.
  - Manzana de Cuba.
  - Prieto.
  - Rosa.
  - Tres Cientos.
- British North Borneo:
  - Bisi.
  - Pisang Lallang.
- Sarawak:
  - Ambun.
  - Ampawar.
  - Betaun.
- Sarawak—Continued.
  - Gala kling.
  - Gala ulu.
  - Hotel.
  - Jernang.
  - Madu.
  - Masak ijoh.
  - Masak terjun buah.
  - Mas kling.
  - Mas Sarawak.
  - Plimbang.
  - Rajah malacca.
  - Rajah Tambi.
  - Sabah besar.
  - Sebadat.
  - Susu petri.
  - Tandok dagang.
  - Tembatok.
  - Turak petri.
- Formosa: Funcho.
- Saigon:
  - Chuô'i già.
  - Chuô'i su'.
  - Chuô'i lu'a.
  - Banane mignonne.
  - Banane Gabou.
  - Banane Valéry.
  - Banane Malgache.
  - Chuô'i lá.
- Java: Pisang radja.
  - Pisang lampenang.
  - Pisang ambon.
  - Pisang Radja sereh.
  - Pisang gembor.
  - Pisang mas.
  - Pisang Radja siam.
  - Pisang Radja tandock.

Considering the very slight expense occasioned thus far in assembling the above 276 varieties of bananas and plantains, and also the fact that it should be quite easy to increase this list during the current fiscal year, we feel much encouraged in this supposedly difficult task of getting accurate information regarding the commercial and technical branches of the banana subject in the Philippines. At present there is probably no one feature of Philippine horticulture, considered both from the Filipino farmer's and the exporter's standpoints, that makes for such splendid success along either home-comfort or financial business lines as does this increasingly popular matter.

A TWO-MAN PRESS FOR MAIZE-LEAF FODDER.

By **Sam H. Sherard**, *Superintendent, Iloilo Demonstration Station.*

Much has been said and written regarding the question of the local production of forage. That different kinds of forage will grow and make good hay has been demonstrated by the Bureau of Agriculture, but the problem of interesting the Filipino farmers in this industry is another proposition.

In order to interest local farmers in forage production, the writer believes that two things must be done: First, a steady market for the product must be obtained; second, a method must be found whereby this forage can be put into the smallest possible bulk or package for transportation purposes. It is with the second proposition that this article deals.

At the Iloilo demonstration station the writer has constructed a press that has given very good satisfaction with pea-vine hay and maize-leaf fodder. It is made of lumber, and is 60 centimeters square by 120 centimeters high (2 by 2 by 4 feet). There are eight pieces in the press, as follows: Four sides, two closed and two open; two end blocks, one of which is attached to a lever 10 by 12 centimeters and 4 meters long; and two bands, one at each end.

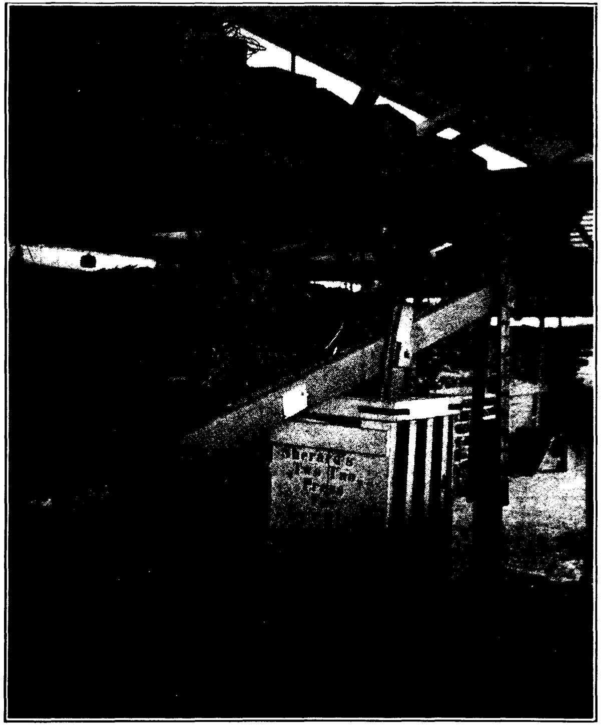
Two Filipinos can make a 50-kilo bale of maize-leaf fodder in five minutes. The length of the lever has a great deal to do with the amount of pressure, and consequently with the weight of the bale. Rattan is used as the tying material.

HOW TO MAKE A BALE OF MAIZE-LEAF FODDER.

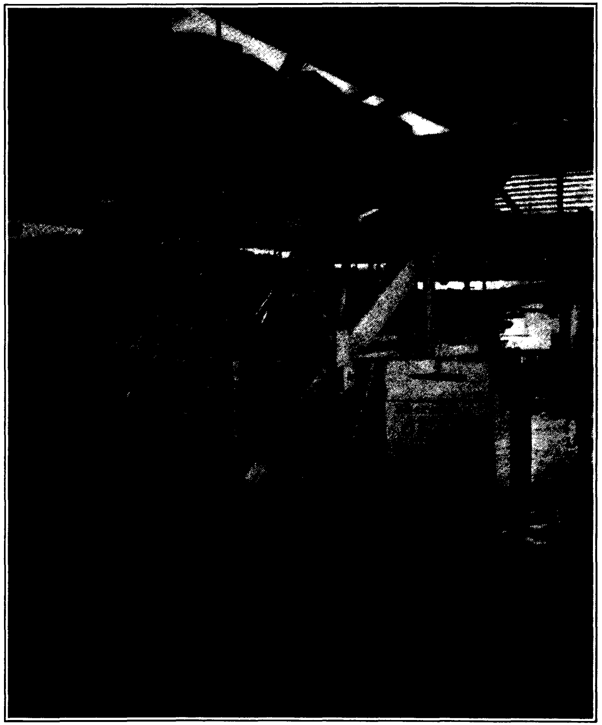
The press is assembled, and three pieces of 2-meter rattan are placed along the open sides and over the tail block; a Filipino gets inside of the press; the fodder is given to him and he places it in the bottom of the press upon the rattan and packs it down with his feet until the press is half full; he then gets out, more fodder is added and the packing is done with the lever and the upper or head block. The lever is held down tightly while the rattan is being tied around the upper end of the bale. The lever is now loosened, the upper band is taken off, and the sides are taken out from the bottom band, leaving the bale of fodder standing endwise on the tail block.

This press can be made by anyone handy with carpenter's tools, and will cost less than ₱5.

PLATE VII.



(*a*) Two-man press for maize-leaf fodder.



(*b*) Two-man press for maize-leaf fodder.

SHALLOW VS. DEEP PLOWING IN MAIZE CULTURE.

By H. O. JACOBSON, *Agricultural Inspector.*

The most noticeable fault to be found with agricultural practices in the Philippines is that of extreme shallow plowing. This is particularly true in the preparation of the soil for maize.

Rarely is the soil plowed to the depth of 10 centimeters, yet this is barely half of the depth which is considered good practice by maize growers in the United States.

The fields which have been in cultivation for a number of years have been plowed at a uniform depth scores of times. The top soil, by reason of much manipulation, the action of heat and rain, the retention of roots, etc., has become of a very different composition and character than the soil underneath. It is true that there is a difference in the virgin soil, but this difference becomes more marked under cultivation.

Underneath this layer of surface soil is the furrow bottom, which, being continually tramped and compacted by the feet of the animals drawing the plow, forms a hard crust, especially in clay soils, that resembles hardpan, which practically prevents the passage of either water or the roots of plants.

The formation of this crust, or "plow sole," is further augmented by the sliding and compressing action of the plow bottom and by the settling of fine soil particles when the surface soil is saturated, which clog the pores or small openings that remain.

In our systems of farming, no crops are grown having thick, stiff tap roots capable of penetrating this "plow sole" and remedying this condition, so that eventually a crop growing in the field has its root system confined to this shallow layer of soil.

The purpose of plowing is to loosen the soil, thus increasing its water-holding capacity, allow more air to enter, and enable the roots to pass easily through it.

As a perfect host for the plant the particles of soil must have a film of water surrounding them, but there must not be so much water that the spaces between the particles are also filled, thus excluding the air.

It is evident, therefore, that this shallow layer of soil underlaid with this impervious "plow sole" will, during rainfall, become so saturated with water that air is excluded; as there is no opportunity for the water to pass downward it must either be evaporated by the heat of the sun or slowly seep to the lowest part of the field.

It is thus easily seen that a given area of soil only 10 centimeters deep can retain only a limited amount of water, and that as soon as all the spaces are filled the remaining water will run off the surface.

When this occurs we meet with a very serious problem in agricultural practice—erosion.

When heavy rains occur this upper layer of soil becomes saturated, the surplus water runs off on the surface carrying with it the fine, rich particles of soil, not only to the lower parts of the field, but also into the streams, into lakes, and into the sea.

This soil containing available plant food is permanently lost and must be replaced. Furthermore, the run-off of water makes ditches and gullies in the field which steadily increase in size, ultimately making further cultivation of the field impossible.

Since it is the plowed or cultivated layer of soil that contains the greatest amount of available plant food, it also is true that shallow plowing necessarily limits the amount of plant food that the growing crop can secure for itself.

It is also true that in this shallow depth of cultivated soil there is actually lack of room for the expansion of the root systems.

Let us assume that we have planted a crop of maize on this shallowly plowed field. A heavy rain occurs, and there being no escape for the surplus water downward, it runs off on the surface and causes erosion. A considerable period of time must now elapse before the remaining surplus water has seeped away or evaporated so that the roots may again assume their normal functions.

The root system, confined mainly to the first 10 centimeters of soil, makes it practically impossible to cultivate without doing great injury to the roots. Cultivating at the shallowest practicable depth of 6 centimeters leaves only 4 centimeters in which the roots are safe; but since cultivation in heavy soils is often given at a greater depth the injury may become serious. If a period of drought sets in the moisture is rapidly exhausted, and the soil temperature increases to such an extent that the uppermost part of the root system is greatly injured or actually killed by the heat.

It is an accepted fact that the roots of plants tend to go deeper in warm climates than in those which are cool, if conditions are favorable.

Prof. F. H. King, of Wisconsin, found that when maize plants were 76 centimeters high the root system occupied the soil to a depth of 61 centimeters in a soil containing a considerable amount of clay. However, there was no "plow sole" encountered.

Since the root system of the maize plant is fine and fibrous, with no tap root capable of penetrating a hardpan or dense "plow sole," it can be imagined what happens when it is confined to only 10 centimeters of depth.

As has been stated before, two or more plowings are given a field before planting. If, instead of a second plowing given at the same shallow depth, a second plow of the type used for subsoiling be used, immediately following the first plow, the soil can be stirred to a depth of 20 centimeters or more without increasing the amount of labor or expense.

A subsoil plow does not turn the furrow over, but by means of the flat upright part, to the bottom of which a wedge-shaped share is attached, the "plow sole" is broken up and the soil is lifted and stirred somewhat and deeper plowing is accomplished without altering the position or relation of the surface soil and the subsoil.

Suddenly increasing the depth of plowing whereby a large amount of inert subsoil is placed on the surface may result disastrously.

The subsoil is exceedingly compact, containing little organic matter, and, of course, not being subjected to the weathering processes, is not so suitable for plant growth as the surface soil. For this reason the depth of plowing must be increased gradually. However, if instead of using a subsoil plow, the farmer chooses to gradually increase the depth of plowing, the desired depth of soil culture may be attained in three years, by increasing the depth of plowing about 3 centimeters each year.

Under present conditions the depth of plowing has been determined almost solely by the draft capacity of one carabao. In the plowing of rice paddies the argument for one animal only may be allowed, but to limit field operations generally to this argument is extremely childish, since the most primitive people everywhere have solved the problem of using two or more draft animals as a unit.

If deeper plowing cannot be accomplished with one carabao, two should be used.

The advantages to be gained by deeper plowing are numerous.

By destroying the "plow sole" and loosening up a greater depth of soil, its water-storage capacity is enormously increased, thereby retaining more available moisture during dry weather and preventing erosion to a considerable extent.

More plant food becomes available, simply because there are more cubic centimeters of soil within reach of the root system, if for no other reason.

Since the bulk of the root system will be deeper by not being confined by the "plow sole," danger of injury by cultivation is largely obviated and there is also less risk of damage due to heat in times of drought.

Very sandy soils, however, should never be plowed deeply.

An illustration of the argument for deeper plowing that will be recognized occurs in nearly every field. For example, where the field is back-furrowed—that is, where the surface soil is turned back upon the unplowed land making a deep surface soil—the growth of maize always is superior to any other portion of the field, while in the "dead furrow," where there is little surface soil, but little growth takes place. This shows that, because of the greater amount of plant food and water available on the "back furrow," greater growth is attained.

Because the term "subsoiling" has been used in this article, it must not be inferred that the practice advocated above is equivalent to subsoiling as practiced in the United States or in Europe. In those countries, subsoiling means stirring the soil to the depth of 50 centimeters or more, while in this instance a method of plowing about 20 centimeters deep is outlined.

The problem of constructing a suitable subsoiling plow can easily be solved by any local mechanic who is able to make the native plow.

AGRICULTURAL CONDITIONS IN THE SUBPROVINCE OF AMBURAYAN.

By AUSTIN M. BURTON, *Agricultural Inspector.*

Amburayan, a subprovince of the Mountain Province, is located on the west-central coast of Luzon between the Provinces of La Union and Ilocos Sur. Tagudin, the capital of the subprovince, is the coast town where the bulk of supplies for the central portion of the Mountain Province are unloaded, to be carried inland over the Tagudin–Cervantes trail by bull cart or pack horse.

The subprovince rises from a narrow coastal plain to an elevation of several thousand feet, consequently the climatic and soil conditions vary greatly, making possible quite a variety of crops.

The principal crop grown is rice, approximately 5,000 hectares being devoted to this purpose; the average harvest is 120,000 cavanes.[1] Both mountain and lowland rice are grown, the latter furnishing about 80 per cent of the crop. The mountain rice is planted on the hillsides after the first rains in May or June and is harvested in October or November. Very little care is taken in preparing the ground, which is merely scratched and the rice broadcasted. The lowland rice is planted in July and August and harvested in December and January. This necessarily receives more care than the mountain rice, it being necessary to plant the lowland variety in seed beds, transplant and irrigate.

Camotes form quite an important item in the diet of the people and about 65,000 cavanes is the estimated production for the province. As the American sweet potato is far superior to the camote grown here, a number of plats have been planted and extensive distribution of cuttings will be made as soon as the plants become large enough for this purpose. Corn is grown in the coastal plain and foothill regions, the crop for last year having been 2,363 cavanes. The corn is not of the best quality or yield, so in hopes of improving the status of this staple crop, plats of improved varieties are being planted in the different townships. The seed from these improved varieties will be saved and used for more extensive planting next year.

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[1] 1 cavan equals 75 liters.

Other crops grown are tobacco, cotton, sugar, and cacao. The yield in 1912 of these crops was as follows: Tobacco, 389 quintales;[1] sugar, 652 piculs;[2] cotton, 84 piculs; and cacao, 3 piculs. A considerable portion of the cane grown is used for the manufacture of basi[3] for home consumption. The cotton is used in the home manufacture, on the old-style hand loom, of cloth, blankets, towels, and similar articles. Most of the clothes worn by the natives are made at home.

There are a number of small fertile valleys in the foothill regions where cacao thrives and there is no apparent reason why each home should not have a number of trees planted. With this end in view a large number of cacao seedlings have been grown in the townships adapted to this crop and the trees are being distributed and planted as soon as they attain suitable size. All seedlings so far grown are in a healthy and thriving condition.

Coconuts are grown to a limited extent and are not particularly vigorous nor prolific, probably due to lack of care more than any other reason.

Few papayas are grown, although those at present seen seem to indicate that the papaya will do well here. Seed beds of papaya have also been started in a number of the townships, the intention being to follow the same plan as mentioned above for cacao.

The live-stock reports for 1912 showed 309 horses, 929 cattle, 6,097 carabaos, and 6,050 hogs in the subprovince. The deaths reported in 1912 as due to disease were 3 horses, 46 carabaos, and 43 hogs. Rinderpest caused the majority of deaths among the carabaos. There is at present no rinderpest in the province, the quarantine having been removed March 4, 1913.

A considerable variety and quantity of hardwood timber of the first group is found in the mountains, but on account of the difficulties of transportation little of it is utilized except locally for building purposes.

The construction of a rather extensive irrigation system is now being given serious consideration. The bulk of the land embraced in this proposed system lies in the coastal plain between

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[1] 1 quintal equals 46 kilos. [2] 1 picul equals 63.25 kilos. [3] A native wine.

Tagudin centro and the southern boundary of Ilocos Sur. A preliminary survey showed nearly 6,200 hectares which can be irrigated between a 12-meter contour. This land is divided into a number of small parcels, consequently a number of people would be benefited. That such an irrigation system would be of inestimable value in insuring the rice crop in time of drought is obvious, and the suffering resulting from the short crop of 1911 emphasizes the need of such insurance.

Forty-three kilometers of the Tagudin–Cervantes trail lie in Amburayan subprovince. This is a cart trail and is practically the only outlet from the Mountain Province to the sea, and consequently has to carry a great deal of traffic.

There are as yet no first-class roads in the subprovince, but work is now being done on a stretch of road from Tagudin to the northern boundary of La Union Province. This road is a part of the coast road running through La Union, Amburayan, and the Ilocos Provinces. When this is completed, also a few sections of road farther north which are now being improved, there will be a good road, passable at practically all seasons of the year, running from Aringay, Union, to Laoag, Ilocos Norte.

CURRENT NOTES—SEPTEMBER.

NOTES BY O. W. BARRETT, Chief, Division of Horticulture.

AGRICULTURAL CONDITIONS IN OUR NEIGHBOR COUNTRIES.

The first coconut and rubber plantations in Papua are just beginning to yield encouraging returns, according to the Daily Consular and Trade Reports. While the European population of this very interesting new island territory of Australia is not increasing to any great extent and probably never will be large, a great advance has been made along agricultural settlement lines. The total area now planted is only some 10,000 hectares, but this figure is rapidly increasing. Some 65 per cent of the total cultivated area is under coconuts and most of the remainder under rubber, though some sisal and tobacco are in evidence.

In British North Borneo labor difficulties continue as the principal hindrance to agricultural progress. It is now proposed to put into effect "land-grant" settlement regulations by which Chinese planters may secure small farms on easy terms. These settlements will be connected by government cart roads. There are now about 14,000 Chinese, 4,000 Japanese, and only 300 native laborers in evidence, and these are mostly on the few comparatively large estates. Twelve estates are reported as producing tobacco, while only five are cultivating coconuts, one pepper, and one gambia. One "old" rubber plantation is said to be in evidence near Sandakan, and there are probably others in process of development.

AGRICULTURAL PROGRESS OF CURAÇAO.

An ostrich-farming experiment is now under way in this diminutive but rather important West Indian colony of Holland.

Sisal culture is also being given a strong impetus by the present high prices and the government is encouraging the setting out of large numbers of plants from Trinidad and Surinam. The Sisal Culture Company has recently purchased, according to the

Daily Consular and Trade Reports, some half million suckers. From a personal inspection of the land about the capital, Willemstad, the soil would seem to be very well adapted to sisal culture. Only some crop like sisal, which is almost independent of rains, will be suited to the exceedingly long droughts which freqüently occur in Curaçao. The drought period which caused so much damage throughout the world in 1912 resulted in the death of many of the animals in Curaçao and most of the crops were, of course, a failure, since for nineteen months there were only some 300 millimeters (12.19 inches) of rainfall.

The jipijapa, or so-called panama-hat, industry, owing to improved methods, is progressing very favorably; the fiber itself is, of course, imported from South America. The writer took some of this fiber to Porto Rico from Willemstad in 1903 and the industry in Porto Rico has gradually assumed considerable proportions, although recent export duties in Colombia, Panama, and Venezuela have greatly reduced the profits to the local dealers and manufacturers. By the way, a considerable number of jipijapa plants are now growing finely at the Lamao experiment station.

NEW GOVERNMENT INSTITUTIONS IN BRAZIL.

Increased interest in agricultural schools, breeding stations, and demonstration farms is evident in this great and wealthy South American country. A new type of agricultural institution is called the "Apprentice School;" here are taught not only thremmatology, but the hygiene and correct feeding of all kinds of domestic animals, as well as the various branches of farm mechanics and agrarian practices. The graduates of these agro-technology schools and the demonstration farms find ready employment in the numerous estates which are being established throughout the cultivable areas of eastern Brazil.

The Government is establishing zoötechnic stations at Pinheiro, Lages, and Riberao Preto. First-class breeding stock—horses, cattle, and pigs—are being imported from Europe and America. Besides these stations two model stud farms have been established.

The veterinary service is now an effective arm of the Government; this regulates the sanitary inspection of all live stock, the distribution of vaccines, the isolation of suspected animals, and, of course, the proper scientific study of the various animal diseases themselves.

BANANAS IN GREAT BRITAIN.

The popularity of the banana as a raw-product food is rapidly increasing in Great Britain. The imports into the British Isles are now about one-half million bunches per month; this is an increase of some 50 per cent over the rate of 1911. The bacterial disease of the banana plant will probably decrease the output of certain districts in Central America, if not in the West Indies; the growing demand in England, however, will help to encourage the planters.

TURTLES.

There is a deplorable scarcity of turtle steaks in Manila. While two or three species of edible sea turtles are to be found occasionally in the markets of this city and probably very frequently in the markets of the southern islands, the supply is very uncertain. There is, however, no better flavored meat in the opinion of many connoisseurs than that of the green or leatherback turtles, provided it is properly "dressed" without the too common admixture of sand in the cuts of meat.

Recently a promising industry has sprung up along the coast of Magdalena Bay and Lower California. Here the natives subsist very largely on turtle flesh and the animals may be obtained in season at about ₱1 each. Those which reach the San Francisco market alive are worth ₱10 on the spot. These turtles weight about 70 kilos, or about the same as those of Manila Bay and vicinity.

BRAZILIAN RUBBER.

During the fiscal year 1912 Brazil exported of the four ordinary grades (fine, medium, coarse, and caucho) 42,859 tons of rubber. This tremendous output is something over 5,000 tons greater than that for the previous fiscal year.

Now that the Hevea plantations of Ceylon and Malaya are turning out so much cultivated rubber, however, the quantity exported from Brazil is not much more than one-half of the total production of the whole world.

THE WORLD'S CACAO PRODUCTION.

Scientific horticulture and careful attention to field methods have seldom shown more striking results than in the case of the Gold Coast cacao industry. In 1910 this country ranked fourth among the world's greatest cacao producers, but it now far excels even Ecuador, which was until 1911 the only rival São

Thomé had for first honors. Bad practices and fungus diseases are surely telling on the São Thomé crop; although extension of area has been going on, the crop of 1912 was considerably less than that for 1910 (36,665 tons).

With very little noise or advertisement, the great new cacao country of the Guinea coast has leaped to first rank and will probably hold this place for many years to come. In 1910 only some 23,000 tons were produced; the 1911 crop was nearly double this.

Southern Nigeria, a near neighbor of the Gold Coast, is rapidly developing the cacao industry, the crop for 1911 being an increase of nearly 50 per cent over 1910. Brazil, as was expected when she began her cacao planting some ten years ago, has forged to the front and now ranks as fourth in the 1912 list.

Trinidad, British West Indies, has been suffering for some ten years with a combination of bad cultural practices, absurd overshading, and a very severe fungus disease. The production for 1910 was over 26,000 tons, but for 1912 was less than 19,000 tons.

According to the Gordian of Hamburg, the total production of the world is at present about 230,000 tons, worth, in bulk, about 150 million pesos.

BANANAS IN JAMAICA.

While authorities, especially commercial people, differ, the writer fully agrees with W. Harris, esq., superintendent of public gardens, Kingston, Jamaica, when he states:[1]

> The bananas used locally are very superior in quality to those consumed abroad, because they are allowed to fully mature and get partly ripe before they are gathered.

Most people unfortunately never get an opportunity, outside of the Tropics at least, of eating a banana which has been ripened on the plant. Furthermore, even in the Tropics, the banana or plantain ripening on the stem is very seldom seen outside of large estates where these fruits are grown in a haphazard way or left to actually "run wild." The reason for these fruits seldom being allowed to ripen on the stem is a very deplorable one; petty thievery, or, as the British planters term it, predial larceny, is ubiquitously common right around the world. The owner of the plant, fearing he will not reap the reward of his labors (supposing, of course, he *has* labored with the plant), is virtually compelled to harvest the bunch a little before it is fully mature. This fact may not seem of any great importance in itself, but it really has kept back the due popularity of bananas as *a food for the millions to a great extent.* Certain varieties are almost poisonous when consumed in a raw state unless the fruits have been ripened on the plant; their pecten is turned to starch and sugar only by cooking or by the fruits' becoming fully developed and then "yellowed" on the plant.

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[1] The Jamaica Department of Agriculture Bulletin, vol. 2, No. 6.

There are now some 17 million bunches of the Gros Michel, Jamaica, or Martinique variety exported from Jamaica each year. The value of this tremendous bulk of fruit is about 15 million pesos. This vast crop, however, is raised on less than 40,000 hectares of land.

The demand for banana "figs," or dried ripe bananas, is steadily increasing in Jamaica and several factories are busy trying to fill their orders.

Mr. Harris gives several new recipes for banana puddings and tarts, among the most interesting of which are the following:

BANANA PUDDING, BAKED.

Four ounces bread crumbs, 4 bananas, 2 eggs, 1 pint milk, 4 tablespoonfuls sugar, nutmeg, rosewater (or other flavoring).

Peel and mash the bananas and add to them 2 tablespoonfuls of sugar and a "squeeze" of lime juice, adding nutmeg and rosewater. Place this preparation in the bottom of a well-buttered pie dish. Put the bread crumbs over this. Make a custard with 2 beaten eggs, a pint of milk, and 2 tablespoonfuls of sugar; pour over the whole and bake until a nice brown color.

PLANTAIN (PLÁTANO, OR TINDUK) TARTS.

Take ripe plantains, boil them, and allow them to cool. Sweeten and add spice to taste. Place on thin pastry, fold, and bake.

This "filler" may be colored with any of the vegetable color compounds or, still better, mixed with roselle marmalade.

One point the housekeeper should remember in cooking bananas is that a little lemon juice or juice of the calamondin or lime will "bring out" the true flavor of these fruits and prevent the so-called "mawkish" taste which certain bananas may have unless thoroughly ripe before cooking.

A NEW CULTIVATOR.

In La Vie Agricole, a French journal of modern agriculture, we find illustrated and described a wonderful invention embodying the pneumatic tool with a farm motor vehicle. This vehicle, propelled, of course, by gasoline, is adapted for cultivating crops such as sugar beets, maize, beans, etc. The body of the motor straddles two or three rows of plants and cultivates four rows at one passage. Three pneumatic tubes extending from the air pump apparatus in the front of the motor are connected with hoes or similar weed-cutting tools, each tool being guided by a laborer walking in front of the machine. The pneumatic apparatus working the hoe itself is supported on a small wheel to which is attached the guiding handle in the hands of the laborer. The frequency of the blows delivered by the hoes is, of course, regulated to suit the ground and plants.

Thus, as fast as the laborers can walk and direct the hoes the ground is pulverized, ventilated, and freed from weeds. Another laborer walking behind the motor attends to the hilling-up attachments that shift the loosened earth toward or away from the four rows of plants under attention. Such a machine is, of course, rather expensive and to be used only on large level fields; but in a country where animals are expensive, such an apparatus will undoubtedly be a valuable addition to the future agriculturist's set of farm machines. One of these machines with the four laborers and chauffeur is calculated to do the work of 35 men.

THE WORLD'S CATTLE.

It is not generally known that there is one tropical country which produces so many cattle that the famous Argentine and even the United States are put "hopelessly in the shade" by comparison. Whereas Argentina boasts of about 30 million head and the United States of about 60 million, British India has now, according to late estimates, over 120 million head of kine (probably including carabao). Strictly speaking, it is hardly fair to call the Indian zebus cattle, any more than the banteng of Java and the middle East Indies are true cattle, since they belong, of course, to another zoölogical species.

Another strange feature about the tremendous figure of the cattle, or rather *zebu,* census of British India is the fact that very little of the stock-raising business depends upon the demand for *meat,* since no Hindu uses beef in any form and the Mohammedans use very little. In a country more or less troubled with surra, rinderpest, and other severe animal diseases, this fact of India's possessing more head of "neat" stock than the two next greatest stock-raising countries, i. e., the United States and European Russia (with 37 million head), is as difficult to understand as is the fact that India far excels all other countries except the United States in tobacco production—225,000 tons per annum in a country where smoking is apparently rare and exports of either raw or manufactured product are very low.

Switzerland, with all her world-wide reputation as the country that feeds the world with tinned milk, has only a paltry million and a half head of cattle. Denmark ranks as the country possessing the most cattle per capita—nearly one head for each inhabitant.

DASHEEN.

This comparatively new vegetable, closely resembling the Philippine gabi, a variety of *Colocasia antiquorum,* is now attracting considerable attention in the southern districts of the United States. A circular on this new root crop has just been issued by Mr. R. A. Young, of the Bureau of Plant Industry, Department of Agriculture, Washington, D. C.; this pamphlet gives full cultural directions and an excellent set of recipes for serving the tubers.

Besides the ordinary methods of cooking the starchy content of the root, which, by the way, is much better flavored than the ordinary gabi, a new idea has been brought out—the forcing of ripe tubers and rootstocks with the object of using their asparaguslike shoots as a salad vegetable. The young leaves of the growing plant may also be boiled and used as a spinach, or "gulay." Strangely enough, several of the best new varieties of dasheen have been introduced during the past few years from Japan. The writer introduced this vegetable into Porto Rico and the United States from Trinidad in 1903.

The word is a corruption of the patois phrase for either *des Indes* or *de la Chine,* this vegetable in Trinidad evidently having been supposed to be an oriental crop.

Several of the best new dasheen varieties are now under propagation at the Singalong experiment station.

AVOCADOS.

A recent shipment of bud wood of 48 varieties of this very important fruit having just been received from the United States Department of Agriculture, Washington, D. C., the question of the future popularity of the avocado is again brought to the surface. The fact, however, that most of the old seedlings from Hawaiian fruits have now proved themselves and give fair assurance of their adaptability to Philippine climatic conditions, there seems no longer any good reason why one interested in first-class high-priced fruits for the market should not give special attention to the planting of the avocado. A tree about

8 years old in Manila has just finished ripening over 300 fruits of first-grade size and flavor. The old seedling trees at the Lamao experiment station, which were severely infested with insect pests a few years ago, have recovered and several have borne a fair crop this season.

In passing, it must be remembered that although few varieties are ever seen on the wholesale market, there are in reality no less than 60 or more recognized kinds of this fruit. Of these there are some three or four types or groups: For instance, the thick-skinned varieties of Guatemala and Honduras would hardly be considered by the casual observer as related to some of the almost skinless Mexican sorts. Again, some of the shining black Central American varieties would hardly be classed with the red, yellow, and green sorts of Venezuela, Cuba, and Porto Rico. The shapes vary from round to long-necked forms; and the sizes run from, say, 50 grams to 1 kilo.

A promising new variety has just been discovered in Venezuela and another has been sent in to Washington by a collector in Chile. From central Chile to southern California and from Panama to Barbados there are very interesting possibilities in this line, speaking both commercially and scientifically, and the next decade will probably see a great deal of work done in avocado crossbreeding and selection. Orchardists in southern Florida are already beginning to plant out seedlings with the idea of saving those which stand the fruiting test, giving them names just as seedling oranges, pomelos, and apples are named and thereafter propagated by buddage; most of the Florida as well as the California avocados are budded nowadays, i. e., they are *named* varieties, on a par with the named citrus fruits.

One feature of avocado growing not to be neglected here is the selection of varieties that will fruit during the dry season. This would avoid possible loss of fruit through injury by wind and rain.

Another thing which will tend to make the avocado one of the few really important fruits of the future is the very high nutritive value of the pulp; this contains from 15 to 18 per cent of readily digestible oil besides a fair percentage of starch and sugar. In fact, the avocado is one of the few fruits which would serve as an emergency ration without any other food for a considerable time. The reputed aphrodisiac qualities of the pulp are probably quite nonexistent. The comparatively high price of the fruit on the retail market, depending largely upon the supply, of course, is almost entirely responsible for the slow progress of this fruit toward world-wide popularity.

NOTES BY P. J. WESTER, Horticulturist.

NEW FORAGE PLANTS FOR THE PHILIPPINES.

Less than twenty years ago the Florida velvet bean, *Stizolobium deeringianum,* was cultivated merely for its ornamental value, and its great value as a forage and a cover-crop plant was just beginning to be appreciated. The history of the Lyon bean, *Stizolobium lyonii,* as an economic plant is limited to less than a decade, and it has just become well introduced into the United States. Both these species are extremely valuable legumes in the Tropics and subtropics, notwithstanding which, relatively speaking, both have their faults. For instance, both have a long season of growth, which in a subtropical climate is objectionable in that the vines are frequently frozen before the seeds mature. A good seed producer, yet the velvet bean is inferior in this respect to the Lyon bean. The Lyon bean, on the other hand, has been accused of shelling its early matured beans in the field before all have ripened. In order to combine the good qualities of each species, Mr. John Belling, assistant botanist of the Florida Agricultural Experiment Station, Gainesville, Fla., some two or three years ago hybridized them and as a result obtained a large number of hybrids. Most were, as is usual in such cases, of no value agriculturally, but several were found to be distinct improvements.

Mr. Belling some time ago sent the Bureau of Agriculture seeds of several of his most promising hybrids and also a considerable quantity of seeds produced by hybridizing the two aforesaid species. The seeds have been sown at the Lamao experiment station, and the plants are making good progress. From the present outlook the Philippines, through these hybrids, will gain a number of new and distinctly valuable forage and cover-crop plants.

One of the prominent forage grasses of India is *Pennisetum cenchroides,* a grass of rapid and luxuriant growth, to which the attention of the writer was first called in south Florida, where it had been accidentally introduced, probably in fertilizer or packing material. After considerable correspondence seeds were obtained from Ceylon some time ago from which a small plat is now establishing itself. It is to be hoped that this new introduction may be more successful than several grass introductions of the past, notably the Teff, *Eragrostis abyssinica,* and Natal grass, *Tricholæna rosea,* which were introduced within the last two years, both of which failed to maintain themselves, and the Australian river grass, which is too unproductive and of too undesirable a habit to be worthy of cultivation. Of those that have been tested guinea grass is by far the best yet introduced for green forage and Rhodes grass the best for hay. Though of fair growth, we fail to perceive any growing enthusiasm for the molasses grass which was introduced two years ago.

NEW SOURCES OF PAPER.

As the population of the earth increases and the needs of humanity multiply, and the inhabitants of the Temperate Zone discover that after all the habitability of the equatorial belt, with its large area and with its enormous agricultural possibilities, is a question of sanitation and right living, at a correspondingly rapid pace will man invade the Tropics in search of these needs that the overpopulated, and from the viewpoint of agricultural production, the "slow," Temperate Zone fails to supply. One of these wants is paper, and for quite a number of years a common topic of discussion in technical as well as popular publications has been the approaching paper famine. While the pine forests of the Temperate Zone were the principal source of supply for a demand that was increasing by leaps and bounds it did indeed appear serious to the pessimist devoid of imagination, and who did not think of the Tropics, where things grow while one waits, so to speak.

Not so long ago the Philippine Bureau of Science announced that the requirements for the manufacture of paper from bamboo had been worked out by a member of the scientific staff of the Bureau, and a well-written paper on the subject was published by the same Bureau and the matter is still fresh in the minds of the well informed. In the meantime another source of paper has been discovered that opens up new possibilities in tropical agriculture as noted in the agricultural bulletin of the Federated Malay States.

The February issue of this, our valuable contemporary, contains an article quoted from the Kew Bulletin on the utilization of certain *Zingiberaceous* plants for paper manufacture that is of great interest to the Philippines, considering that the most promising of the plants discussed, *Hedychium coronarium* Koenig., grows wild in the Archipelago, not to speak of the numerous related species the value of which has never been investigated, and which luxuriate in most parts of the Archipelago.

It appears that the paper-making qualities of *Hedychium coronarium* are equally good whether the fiber is produced from the green material or the dried plant, a great advantage both from the growers' and the manufacturers' point of view. We quote the following:

> Papers produced from this fiber (made from *Hedychium coronarium*) have even greater tensile strength than the strongest Manila papers produced. * * * Its elasticity and folding qualities are exceptional. Moreover, it can be made to bear ink and possesses parchment qualities without any sizing or other special treatment. The reason for this we find to be due to the presence of the cells associated with the fiber, which are of a semigelatinous nature when chemically treated, and dry into the interstices of the paper and produce natural parchment. * * * The pitch cells, which can be retained or not, according to requirements, possess very peculiar qualities. If taken alone, the unbleached cells when dried go down to a horny mass, which can only be broken with very great difficulty with a hammer, and are softened only with difficulty when boiled in soda. If retained in the paper, they give it parchmentlike properties to an extraordinary degree. They also render the paper ink bearing without the addition of any sizing material. * * * On the other hand, paper made from *Hedychium* from which the cells are removed is of a soft nature and of medium strength, but that in which the cells are retained * * * gives higher "breaking lengths" than any manila paper that we have so far had the opportunity of examining. The oval cells, therefore, "parchmentize," strengthen, and size the sheet. * * * We draw attention to this fiber, as we believe it may become of great industrial importance to the paper trade. Where circumstances are congenial to its growth, the plant spreads to the exclusion of all other vegetable growth by means of its rhizomes, so that it can be harvested at least once a year, producing a heavy crop. It is an easy pulp to manipulate. It is capable of producing a paper of exceptional strength and can be worked either bleached or unbleached. The fact that the paper in its natural state, without the addition of any material whatever, can be made to possess grease-proof and self-sizing qualities is a point of commercial importance.
>
> * * * The tensile strength tests indicate that the fiber from the green stem is almost exactly similar in strength to the best pure manila binder twine.

In conjunction with the investigations of *Hedychium coronarium,* which were made in London, England, tests were also made of two other related species, *Amomum hemisphericum* and *Alpinia nutans,* both indigenous to the eastern Tropics. The paper produced from these species is of good quality, although they do not possess the extraordinary paper-making qualities of *Hedychium coronarium.*

The natural habitat of *Hedychium coronarium* and related plants is low, moist, rich land in swampy situations, along streams and rivers. All are of easy and vigorous growth and well able to hold their own against other vegetation once they are well established, and they are readily multiplied and propagated by the division of their underground rhizomes. The stems of *Hedy-*

chium coronarium reach a height of from 1.5 to 2 meters and are 2 to 4 centimeters in diameter. The plant requires a period of four to five months to attain its full growth between each cutting. The stems of *Alpinia nutans* and *Amomum hemisphericum* attain a height of about 3 to 4.75 meters, respectively, and several of our Philippine *Zingiberaceous* plants, which *might* be equally valuable as a source of paper, are also equally vigorous in growth.

We should like to see some one investigate this possible source of revenue to the Philippines.

NOTES BY M. M. SALEEBY, Chief, Fiber Division.

MARKETING OF PHILIPPINE KAPOK.

In establishing a new line of trade, in any country, especially with respect to a commodity well known in other countries, great precautions must be taken to obtain a reputation in that particular line. The infancy of any industry is its most delicate stage, and an improper start invariably results in an undue delay in its successful establishment or in its speedy death. A false impression can be easily and speedily created, but a rectification of this may take many years at the cost of considerable trouble and expense.

The production of Philippine kapok as an article of export is comparatively recent, and the industry may justly be considered as in its infancy. This, therefore, means that the product should be so prepared and marketed as to attract the attention of the consuming markets and compare favorably with the product of other countries. The establishment of a favorable reputation for Philippine kapok should, therefore, be the prime object of all parties interested in its production and export. This timely notice is prompted by the receipt of communications from kapok consumers in the United States and Australasia to the effect that Philippine kapok reaches them in a semicleaned state. Next to Holland, these markets are the most important with respect to kapok, and it is principally to them that the Philippines should look for the sale of its product.

Several kapok plantations have recently been established in the Philippines, and it is hoped that more will be established in the near future. In the course of a few years considerably more quantities of floss than at present are expected to be placed on the market, and in order to increase the production of kapok and develop the industry to the extent to which it is entitled, it is of the utmost importance that all exporters should take the necessary precautions, more particularly at this stage, to supply the markets with the product in exactly the quality and condition necessary. Machines for cleaning the seed are now available, and they should be secured for use, even though the present quantities of kapok entering the market are not sufficient to warrant their continual use. Careful baling and durable and proper wrapping of the bales are both necessary. Philippine kapok, when carefully cleaned, compares favorably with the kapok of any other country, and the demand for it is bound to increase as long as its qualities remain unimpaired.

PRODUCTION AND PRICES OF ABACÁ (MANILA HEMP) DURING FISCAL YEAR 1913.

Whenever a prolonged drought or a severe typhoon occurs in any of the principal abacá provinces of the Philippines, an undue and unwarranted confusion of the local and foreign markets usually follows. Such a confusion can be accounted for by false rumors, by hurried and inaccurate reports, and by the actions of certain buyers or brokers of influence. As a result of these causes prices fluctuate abnormally and without sufficient justification, leading in turn to irregularities in the supply of fiber. These invariably afford opportunities for speculation on the part of the brokers, and the markets ordinarily remain in an unsettled condition for a year or two. Such has been the status of the abacá industry since the drought of 1912, and it will probably take another year before conditions become normal again.

In order to prevent the occurrence in the future of any such confusion in the local and foreign fiber markets, it will be necessary that these markets should be adequately acquainted as soon as possible with the actual condition of the industry subsequent to the occurrence of a drought or typhoon. With this end in view this Government, through the Bureau of Agriculture, is now prepared to inaugurate a quick service whenever similar occasions arise in the future. The best interests of the producers and the manufacturers require that the market be steady and that, if a fluctuation occurs one way or the other, it should be in response to the law of supply and demand.

The fluctuations in production and prices of abacá since July, 1912, bear a significance to all parties interested in the industry. These data, in connection with the same data for the fiscal year 1914 (July 1, 1913, to June 30, 1914), will form a complete record which will undoubtedly help considerably to forecast the trend of the industry, should the same or a similar calamity to the abacá crop occur in the future.

The actual production of abacá during the past fiscal year (1913) will not be known for a few months yet, but the exports during the same year amounted to 144,576 metric tons, valued at ₱46,089,488, or a decrease of 9,471 metric tons in quantity and an increase of ₱13,522,468 in value over the exports during the fiscal year 1912. The following tables give the receipts of abacá at all shipping ports in the Philippines since July 1, 1912, together with the fluctuations in prices during the same period. Table No. 1 is compiled from the weekly reports of the Manila Chamber of Commerce and Table No. 2 from the daily quotations in the Manila market. Similar figures will also be compiled for the fiscal year 1914, at the end of which it is believed the market will again be normal.

TABLE NO. 1.—*Receipts of abacá at all ports from July, 1911, to June, 1913, inclusive.*

Month.	Fiscal year 1912.	Fiscal year 1913.
	Bales.	*Bales.*
July	71,197	123,528
August	87,176	109,989
September	96,458	120,082
October	113,428	104,708
November	84,605	98,128
December	134,381	118,591
January	119,882	87,386
February	96,378	89,198
March	101,051	100,212
April	123,304	60,886
May	123,580	71,910
June	136,685	74,818
Total	1,288,125	1,159,436

NOTE.—One bale weighs about 125 kilos (275 pounds), thus giving approximately 8 bales to the metric ton.

TABLE NO. 2.—*Fluctuations in the prices of abacá in the Manila market from July, 1912, to June, 1913.*

[Prices in centavos per kilo.]

Month.	Good current.	Midway.	Current U. S.	Superior seconds.
1912.				
July	27½ to 38½	25⅓ to 34¾	19¼ to 27	11½ to 14¾
August	36⅓ to 39½	33¼ to 35½	25⅓ to 27½	14¾ to 15¾
September	39½ to 42½	35½ to 38½	26¾ to 28½	15¾ to 17½
October	42¾ to 45¾	38 to 41	28½ to 30	17¾ to 22¾
November	47½ to 50½	42¾ to 45¾	30 to 32¼	19½ to 23½
December	50½ to 52	45¾ to 47½	32 to 34¾	21 to 23½
1913.				
January	52 to 53½	47½ to 49	33¾ to 36½	22½ to 24
February	48 to 52	41 to 47½	30 to 33¾	20½ to 22
March	48 to 48	41 to 41	28 to 30	20 to 22
April	44 to 47	37 to 41	26 to 28	20 to 21
May	41 to 44	36 to 37	26 to 27	20 to 21
June	39 to 41	34 to 36	23 to 26	18 to 19

SCARCITY IN PRODUCTION OF HIGHER GRADES OF ABACÁ—ITS CAUSES AND REMEDIES.

During the last six or eight years there has been a scarcity in the production of the grades of abacá, including good current and better; but since the 1912 drought this scarcity has become more evident than perhaps at any other time prior to the occurrence of this drought. When we consider the fact that the value of these high grades has during the last year or so proportionately risen much higher than that of the lower grades, and the further fact that the demand for the former has been and is still far in excess of the supply, we cannot but feel the utmost surprise and disappointment because the producers do not respond to the requirements of the market, which in this case happen to be in direct accord with their best interests. It is its admirable qualities in the higher grades that have given abacá an undisputed rank as the premier cordage fiber of the world, and therefore any reduction in the production of these grades is bound to injure its reputation and consequently strengthen the position of all competing fibers.

The present scarcity in the higher grades of abacá is due to several causes, chief among which may be mentioned the following: First, insufficient discrimination in prices on the part of the majority of the local provincial buyers, which is encouraged by the economical dependence of the majority of producers on the buyers who are also either merchants or money lenders, or both; second, lack of control over the laboring class (strippers) on the part of most of the producers; and third, to the rise in the prices of the fiber, which in turn is chiefly caused by a shortage in production. This last appears to be a paradox, but, peculiar as it sounds, it is nevertheless true. The only explanation that can be made of such peculiar conduct on the part of the small producer, who supplies the larger part of the crop, lies in the fact that as long as the proceeds from the farm satisfy his immediate necessities of life he is usually content, and not prone to push his interests beyond that limit. In other words, as long as he can make a living with comparatively easy work, the small producer is not, as a rule, inclined to work harder and make money which he does not immediately need.

A careful analysis of the present situation will at once show that the remedy lies chiefly in the institution of either or both of the following agencies, planters' coöperative associations and local agricultural banks. The first must originate among the progressive class of producers in each town or district, not only for the protection of themselves but also for that of the uneducated class of small producers. The second must be instituted by the Government at the capital of each of the principal abacá-producing provinces, and will serve to enable the producers to market their product where they can obtain better prices, and will also serve to free them from their economic dependence upon the local buyers. Such banks, it is understood, have been successfully instituted for the benefit of the sugar producers of Iloilo and Negros. The abacá crop is much more important to the Filipinos in general than the sugar crop, and the number of people dependent upon the former crop for a living is considerably larger than that depending upon the latter. Besides, the producers of abacá are, on the whole, poorer than the producers of sugar, and are certainly entitled to as much, if not more, attention than the producers of the latter commodity.

BOOK REVIEW.

BY O. W. BARRETT, Chief, Division of Horticulture.

COCOA, ITS CULTIVATION AND PREPARATION.

By W. H. Johnson, F. L. S.

This new work on cacao will meet with much favor in British tropical colonies, being as it is a complete handbook for the planter who wishes to put his estate in a thoroughly up-to-date condition. Mr. Johnson, the present director of agriculture for Southern Nigeria, has had thorough training in several of the major tropical crops both in West and East Africa. The author has wisely endeavored to make this book of high value not only to the African planters but to those of Samoa, West Indies, and South America as well. He has not even forgotten the manufacturers in an excellent chapter on "Commercial Cocoa, Its Manufacture and Uses." By the way, it is regrettable that the author has used the obsolescent word "cocoa" to mean not only the manufactured product (which is quite correct), but also the plant and its raw product, thus giving support to the old error which in most tropical countries has fortunately now fallen into disuse.

This work, which is one of the new Imperial Institute series of handbooks on the commercial resources of the Tropics, stands, perhaps, as the most condensed and concise cacao handbook, not to except the works of Wright and Hart, that has come before the public.

It is superedited by W. R. Dunstan, director of the Imperial Institute of Great Britain, and published by John Murray of London. It is another verification of the good old adage, "Ex Africa semper aliquid novum." The *supply continent* of the future is inexhaustibly full of good things—authors included.

TEMPERATURE AND RAINFALL FOR AGRICULTURAL DISTRICTS IN THE PHILIPPINES.

By the DIRECTOR OF THE WEATHER BUREAU.

JUNE, 1913.

[Temperature and total rainfall for 24 hours beginning at 6 a. m. each day.]

Date.	Abacá (Manila hemp).				Sugar, Iloilo.		Rice, Tarlac.		Tobacco.			
	Albay.		Tacloban.						Aparri.		San Fernando.	
	Temperature.	Rainfall.	Temperature.	Rainfall.	Temperature.	Rainfall.	Temperature.	Rainfall.	Temperature.	Rainfall.	Temperature.	Rainfall.
	°C.	mm.	°C.	mm.	°C.	mm.	°C.	mm.	°C.	mm.	°C.	mm.
1	28.4	8.7	27.3	0.5	28.7		28.9		28.8		29	
2	28.8		28	14	28.9	1	29.4		29.3		28.4	
3	28.5	.3	27.1	2.8	26.2	6.4	29.9		29		28.1	
4	29.3		27.2	13	28.4	4.6	30.1		28.3			
5	29.2		27.9	10.7	27.9	.5	29.1	23.4	28.6		29.2	19.8
6	28.7		26.5	4.3	26.7	60	28.3		26.4	9.8		
7	29.1		27	6.9	27.3		27.6		26.4		28.8	1.5
8	29.4		26.8	3.9	28.6		28.6	25.4	27.8		26.8	8.4
9	28.5		27.7		28.4		28.2	2.8	28.1	4.8	26.3	29.7
10	29.3		28		28.1	9.1	28.3	15.5	27.2			3.3
11	28.7		27.4		27.1		28.4		28		28.4	2.8
12	28.2		28	20.6	28.1	2.5	28.4		28.7		28.5	.3
13	28.5		27.6	21.3	27.1		28.6		28.8		29.2	14.5
14	28.6	.8	27.3	2.3	27.7	34	28.6		28.5		29	5.1
15	29.1		27.8	1.3	26.9		29		28.5	.8	27.8	.8
16	28.3		26.8	7.1	26.4	3.3	28.8		28.3			36.1
17	28.1		27.5		26.8		29.1	64.8	28.6	3		33
18	28.7		28	7.4	27.8	2.3	27.6	4.8	28.1	3.8		106.2
19	28.3		28		27.2	5.6	28.8	6.1	27.7		25.2	
20	28.5		28.2		27.2		28.8		27.8		26.6	3.3
21	28.7		27.5		27.8		29.1	9.4	28.2		27.5	
22	28.6		28.1		27.4	5.3	29.6	50	27.4	4.1		
23	28.8		28		27.2		29	17.8	28.5		28.2	.3
24	27.6	.8	26.8	13.2	27.2	2	28.9	2	27.1	26.1		.8
25	26.4	9.4	26.4	11.8	27.6		28.4		27.6		27.5	.5
26	26.8	1	25.9		27.3	6.3	28.8		28.5		28	
27	27	31.7	27.2	12.7	27.3		29.1	28.4	28.4		28.4	2
28	26.1	3.3	26.8		26.5	13.2	28	22.9	27	70.4	25	24.2
29	27.8		26.9		27		26.9	1.3	27	1.3	26.6	23.1
30	28.8		27	1	27.9		28.6		28.4		25.2	

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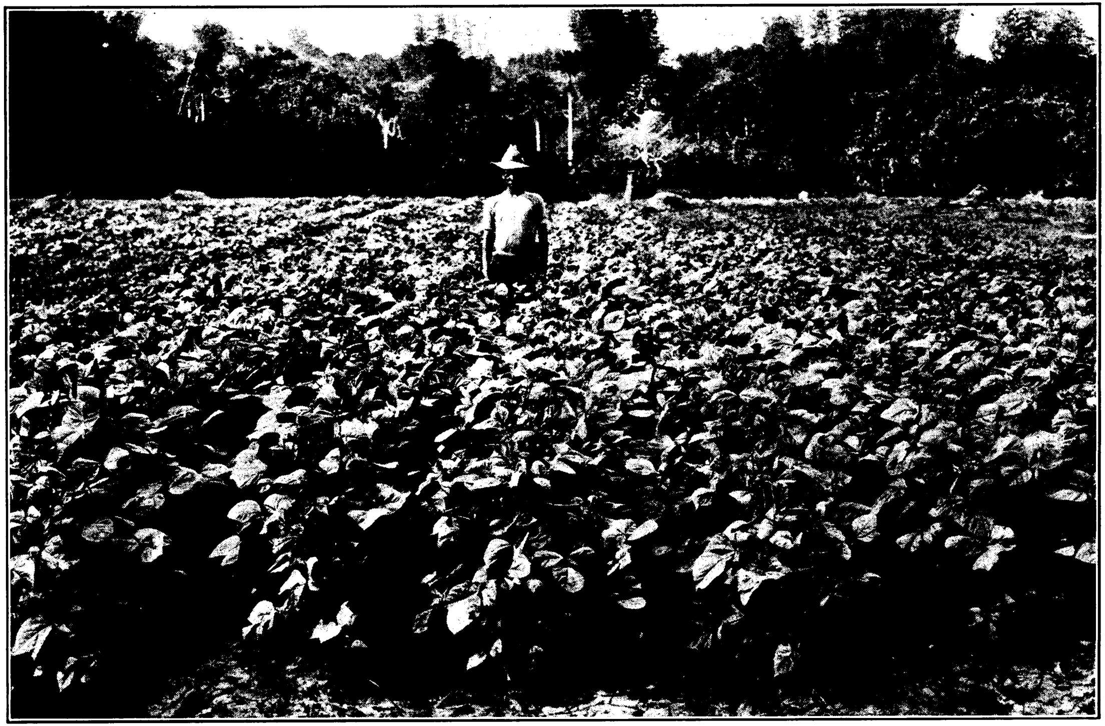

Mungo, seven weeks after planting; grown as a cover crop in citrus plantation, at the Lamao experiment station. Note evenness of stand, abundance of pods, and weed-killing efficiency.

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EDITORIAL.

RECENT PLANT INTRODUCTIONS.

After very discouraging and almost entirely fruitless efforts extending over a period of some ten years, the famous seedless pomelos of Siam have finally been brought into cultivation outside that community. Several efforts have been made, not only on the part of the Government of the Philippine Islands, but also by the United States Government, toward getting in genuine plants or budwood of these fruits. A little propagation material of these fruits was received by this Bureau about one year ago, but not until this month has there been in evidence a good quantity of budwood of the genuine varieties personally taken by a competent expert from trees in situ in the plantations of central Siam.

About five distinct types of these very valuable fruits were collected by an employee of the division of horticulture during September; a report upon the trip is being prepared for a later issue of the REVIEW. It is believed that these varieties of pomelo will revolutionize the so-called "grapefruit" industry of the United States as soon as they can be worked up for general distribution in that country.

Besides propagating material of these Siamese citrus fruits a very large collection (including some 40 names) of Siamese bananas was brought back by the above-mentioned collector; and while en route to Siam he also made important collections of economics, thanks to the kind courtesy of the respective officials in Hongkong, Saigon, and Singapore. It is believed that this trip marks an important step in the progress of the horticultural work of this Bureau.

THE POTENTIAL VALUE OF PARASITES.

For a long time scientists have understood that without certain forces, such as parasites, predators, meteorological agents, etc., practically any species of animal or plant might in a comparatively short space of time overrun its habitat and become a menace to the existence of other living species in that region. In fact, we have now come to realize that it requires only a very slight force upon either side of the "natural balance," as it has come to be called, to produce changes amounting to millions of pesos in importance (as profit or loss in agriculture) as affected by these good or bad factors in man's struggle for existence; and, by the same token, agriculturists now realize principles which a few decades ago were disregarded but are now widely known to be of the utmost importance to the *output of the land,* broadly speaking.

For instance, although the chance of ultimate benefit may be really very slight, scientific agriculturists the world over are now willing to spend vast sums of money in the effort to find some factor which more or less artificially they may put into operation to turn the tide or assist in upsetting the balance of certain natural forces *in their favor.* Although there have been very few cases in the history of agronomy or horticulture wherein it can be clearly proved that man has with definite design successfully assisted beneficial animal species or inhibited those which are known to cause heavy losses in agriculture, there is just enough hope in this line to furnish good excuses for outfitting exploring expeditions into the far corners of the earth with the purpose of discovering beneficial species, and transplanting them, so to speak, where they are obviously needed in the war against pests and diseases.

To take a concrete example, it requires no effort of imagination to appreciate the feelings of the economic entomologist when, after grave difficulties have been experienced in obtaining a natural parasite of a very destructive fruit fly, and after carefully rearing the parasitic insect up to the point where it can be liberated in large numbers to attack the host species (the fruit fly), he sees numerous active female parasites searching with quivering antennæ for the precise spot in the soil where the pupæ of the pest are hidden, then digging away the earth particles until they can deposit the eggs which mean certain death to the host pupæ and thereby the mitigation of the evil, if not the absolute control of the pest, which before the arrival of the friendly parasite had come near to wrecking an industry involving millions of capital.

Parasitology has come to be a prominent branch of modern agriculture. It behooves every planter and every stock raiser, whether he produces cane, rice, maize, fruit, or live stock, to study this science assiduously. The more the planter knows about parasitism facts, even though in most cases parasites are partial failures, the better chance he has of success in his profession. Besides the material side of the question, there is probably no more interesting phase of outdoor biology, once the agriculturist grasps the principles and potential possibilities of this wonderful new line of practical science.

BUREAU OF AGRICULTURE CIRCULAR No. 25—CULTURAL DIRECTIONS FOR VEGETABLES AND FLOWERS.

[CIRCULAR No. 25. Manila, P. I., September 1, 1913.]

CULTURAL DIRECTIONS FOR VEGETABLES AND FLOWERS.

By P. J. WESTER, *Horticulturist.*

LOCATION.

In locating and making a vegetable or flower garden the following points should be kept in mind: (*a*) That the prospective garden must be well sheltered from strong winds; (*b*) that the land must be well drained; (*c*) that the soil must be rich in humus, light, and easily worked.

If not naturally protected by the house and vegetation, a windbreak may be constructed by the planting of shrubs or small trees around the garden, yet it should be well exposed to the sun. Well-drained land is absolutely essential; if the site for the garden is not well drained naturally, drainage must be provided for by ditching.

PREPARATION OF THE GARDEN.

Spade or plow the ground well to a depth of not less than 20 centimeters; break up all lumps, remove all trash, and level the land with a garden rake. If the soil is not naturally fertile and is heavy, stiff, and inclined to bake, it may be improved by adding to it stable manure or decaying vegetable matter and a little sand, which substances should be thoroughly worked into the soil. Do not attempt to work the soil when it is wet and soggy after a heavy rain. The soil is about right for working and planting when it *crumbles and falls apart* under moderate pressure in the hand; the land is then in good condition for planting seed direct in the soil or for the setting out of plants from the seed bed.

SEED BED.

Many plants succeed better if the seed is sown in a seed bed, where, during the early stages of their growth, they may be protected better from the hot rays of the sun, heavy rains, and noxious insects, than if the seed were sown in the open ground. If the seed bed is prepared in the garden a small bamboo frame should be erected over it, and a roof made of palm leaves or cogon grass.

SEED BOXES.

If insects, particularly ants, are troublesome, it is best to sow the seeds in shallow boxes, commonly called "flats." Make the flats about 10 centimeters deep, and in nailing them allow enough space between the bottom boards (3 to 5 millimeters) to provide for drainage; a number of small holes bored in the bottom of the flat will also serve to carry off any surplus water.

Cover the bottom of the flat with a layer (about 2 centimeters deep) of coal ashes, gravel, or small stones, and then fill the flat to within a centimeter of the top with fine, rich, preferably *sandy* loam; heavy, *sticky* loam is not suitable. Firm the soil moderately before sowing the seed.

Sow the seeds in rows about 4 to 5 centimeters apart, from 3 to 10 millimeters apart in the row, depending upon the size of seed and vigor of the plant. Cover the seed slightly with a layer of soil—of the thickness of the seed planted, is a good rule—and firm the soil well and then water thoroughly.

After having planted the seed do not allow the soil in the flat to dry out, or the seed will not germinate; nor, on the other hand, should it be watered so often that the soil is kept continually wet and soggy—for in this case the seed decays or the young plants are likely to rot off at the surface of the ground. With many plants this stage is the most critical in their development and many are lost by excessive watering.

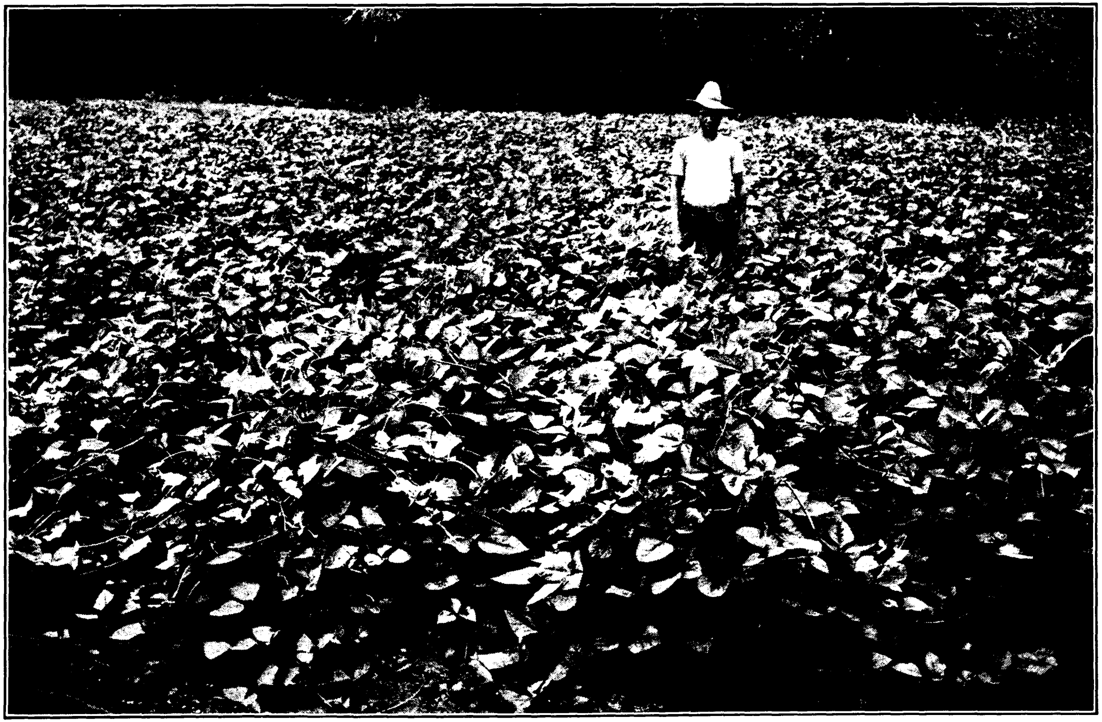
After the plants have appeared above ground, a good rule is to allow the soil to become so dry that the plants are on the point of wilting and *then water the flat thoroughly* so that the water penetrates to the bottom. Frequent and shallow watering is very pernicious in that it encourages a root system near the surface of the soil and prevents the development of deep-going roots, and thus stunts the plants.

Weeds should, of course, be pulled out whenever they appear.

If ants and other crawling insects are troublesome, place the seed boxes on a table made of bamboo with the legs standing in tin cans filled with water.

Lyon bean (*Mucuna lyonii* Merr.), three months after planting; grown as a cover crop to kill weeds and grass and to enrich the soil; Lamao experiment station. Note bamboo tripods for supporting seed-bearing vines.

PLATE III.



Cowpea, "New Era" variety; ten weeks after planting; grown as a "blanket," or cover crop to enrich soil in citrus plantation at the Lamao experiment station. Note dense stand, heavy seed production, and vigor of plants.

TRANSPLANTING.

When the young plants begin to crowd each other transplant them into other boxes prepared as heretofore described, about 3 to 5 centimeters apart. Before removing the plants the seed flat should be watered thoroughly and the flat into which the plants are transplanted should be well watered after the operation.

PLANTING IN THE OPEN.

When the plants are 6 to 12 or more centimeters tall, depending upon the kind, they are ready to set out in their permanent position. It is well to place the plant box in the full sunlight a few days prior to setting out the plants in order to accustom them to the change. The transplanting of the plants from the seed bed or flat to the garden is best accomplished during a cloudy day or late in the afternoon. Cut off about one-half of the leaves. Disturb the roots as little as possible, and firm the soil well around them when the plants are set out.

In the case of some plants, such as beans, peas, radishes, carrots, maize, cucumbers, melons, okra, etc., it is better to plant the seed direct in the field, as they do not transplant well. If for any reason, however, it is desired not to do so, make small baskets of banana leaves or stalks about 8 centimeters in diameter, fill them with earth, and place them side by side in a flat. When the plants are large enough to set out in the field, water the plants thoroughly, carefully remove the basket, and set out each plant with its ball of earth *without breaking it.*

SAVING SEEDS.

Vegetable seed deteriorates so rapidly in the Philippines at sea level that it is usually not advisable to collect seed for planting another year, the better plan being to obtain fresh, imported seed for each season. With flowers, however, the seeds may be kept for planting another year. Save the seeds from the best plants when they are ripe, spread them out to dry on a paper *in the shade,* and when well dried place them in a tightly corked bottle. It is well to remember that seeds do not, as a rule, retain their vitality long in the Philippines, and that the sooner they are planted the better.

PLANTING DISTANCES FOR VEGETABLES.

No general rule can be laid down as to distances at which to plant, as this depends upon the character of the plant, and, to some extent, upon the fertility of the soil. The following table indicates the approximate distances that should be used for the most common vegetables:

Table showing at what distances the most common vegetables should be planted in the field and garden.

Name of plant.	Distance in row.	Distance between rows.
Beans:		
Lima (hills)	1 meter	1.5 meters.
String (seeds)	10 centimeters	50 centimeters.
Beet	Drill	35 centimeters.
Cabbage	50 centimeters	75 centimeters.
Carrot	Drill	30 centimeters.
Cucumber (hills)	1.5 meters	2 meters.
Eggplant (hills)	60 centimeters	75 centimeters.
Garlic	5 centimeters	25 centimeters.
Lettuce	15 centimeters	15 to 30 centimeters.
Maize (hills)	1 meter	1 meter.
Melon	1.5 meters	1. 5 meters.
Melon, water	2 meters	2 meters.
Okra	50 centimeters	1 meter.
Onion	Drill	30 centimeters.
Parsley	do	25 centimeters.
Peas	do	50 to 90 centimeters.
Pepper	40 centimeters	75 centimeters.
Radish	Drill	20 centimeters.
Roselle (hills)	1 to 2.5 meters	1 to 2. 5 meters.
Squash	1.5 meters	2 meters.
Sweet potato	40 centimeters	1 meter.
Tomato	60 to 75 centimeters	Do.
Turnip	10 centimeters	50 centimeters.

HERBACEOUS ORNAMENTALS.

The following is a list of annual and perennial flowering herbaceous plants that will succeed in the Philippines with ordinary care, and whose propagation is not difficult:

Amaranthus (seed).
Angelonia grandiflora (cuttings and roots).
Calliopsis (seed).
Canna (roots).
Celosia, or cockscomb (seed).
Coleus (seed and cuttings).
Coreopsis (seed).
Cosmos (seed).
Dahlia, annual (seed).
Gaillardia (seed).
Gomphrena (seed).
Helianthus, or sunflower (seed).
Helichrysum (seed).
Iberis, or candytuft (seed).
Impatiens balsamina, or balsam (seed).
Mirabilis jalapa, or four o'clock (seed).
Nasturtium (seed).
Phlox (seed).
Roselle (seed).
Salvia splendens (seed and cuttings).
Tagetes, or French marigold (seed).
Verbena (seed and cuttings).
Vinca, or periwinkle (seed).
Zinnia (seed).

Fresh-water sand is the most suitable medium for the rooting of cuttings; if this is not obtainable, use light, sandy loam. Put the sand or soil in a flat as already described under seed boxes and set in a well-sheltered, shady place. Make the cuttings from 5 to 7 centimeters long, and trim off about two-thirds of the leaves; then insert the cuttings in the rooting medium to about one-half or a little more of their length, pack the soil or sand well around them, and water thoroughly. When the cuttings have rooted, transplant them into a shaded bed with good garden soil and when they have made good vigorous plants transplant them to the flower bed.

INSECT CONTROL.

Most insects that attack plants in the seedling stage devour the foliage and tender shoots. They are easily controlled by dusting the plants with a mixture of Paris green and air-slaked lime, dry road dust, or fine soil. For this purpose mix 25 grams Paris green to 1 kilo of the diluting substance and stir together the two ingredients thoroughly. Place the mixture in a bag of cotton cloth and shake it over the plants until they are covered with a thin layer of dust. This is best done in the morning while the plants are still wet with dew. Do not apply the mixture thickly as it may injure the plants.

Cucumbers, squash, melons, eggplant, and okra are frequently troubled by aphids, which are small green or brownish sucking insects. These are readily destroyed by the application of tobacco dust. The aphids usually attach themselves to the under side of the leaves and in order to be effective the tobacco dust should therefore be thrown on the plants *from the side and upwards.* Apply the tobacco dust early in the morning while the plants are wet with dew. Repeat the application at intervals of two or three days until the insects have been eradicated.

For other insect pests and their control see Circular No. 12.

Remember that Paris green is a dangerous poison and therefore should never be placed where it is accessible to children or animals.

THE PHILIPPINE LOCUST (*Pachytylus migratoroides*, R. & F.); NATURAL INFLUENCES AFFECTING ITS PROPAGATION AND DISTRIBUTION.

By D. B. Mackie, *Assistant Entomologist.*

In devising remedies for any pest the essential things are a complete knowledge of its habits and a full understanding of the conditions under which it develops. We know that all forms of life, especially those still in a state of nature undisturbed by man's influence, are subject to certain checks which tend to prevent the undue increase of any species and thus maintain a "balance of life."

As the conditions which govern this balance are extremely complex it is often difficult to understand the causes which lead to the results. It is well known, however, that the natural increase of almost any insect species would be very large if the restraining checks were removed.

In order to realize the influence exerted by these checks let us consider what the rate of increase in the common migratory locust would be if not inhabited by natural agencies: Assuming that each female locust lays 60 eggs of which 30 are females, it follows that if each of these 30 pairs reproduces in the same ratio, the progeny of one locust at the end of one year, or the third generation, would be 54,000, of which 27,000 would be females and the next generation would contain 1,620,000 individuals, or enough to make up a fair-sized "swarm."

A mature locust weighbs approximately 3 grams; the progeny of one locust in the fourth generation would be nearly 5 tons of locusts. As each locust consumes approximately 300 times its own weight in food, the progeny of one locust in the fourth generation would consume some 1,500 tons of vegetation which, in the case of young maize, cane, or rice, would make a few fields at least *look rather bare.*

Even admitting the above to be overestimated by 50 per cent, it can be readily imagined what the progeny of one of these vast swarms, which sometimes appear, would be if allowed to reproduce quite free from all natural checks; and when we consider these figures it is impossible not to realize the great influence that must, in almost every case, be exerted by nature in holding the balance against this normal ratio.

Generally speaking, the forces which operate for or against any species may be stated as climate, food supply, and enemies.

CLIMATE.

Under this heading may be included such checks as temperature, wind, rain, and drought.

Climatic influences exert the greatest checks on locusts, since all forms of insect life are more or less sensitive to them.

Temperature.—While the element of temperature in many countries exerts a powerful influence on locusts by causing them to hibernate for extended periods, yet in a country like the Philippines where the weather is never cold enough to cause them to hibernate, it is not of great economic importance.

Winds.—Winds are a very important factor, especially in locust distribution and control.

With a moderate wind swarms are often enabled to make long sustained flights, even crossing from island to island, as for instance from Cebu to Negros. In this way island provinces that have been free of the pest may suddenly become infested from some province 100 or 200 kilometers distant by the opportune occurrence of a favorable wind coming at a time when the swarms are migrating.

As a general rule, high winds tend to keep locusts near the ground and to prevent extended flights, and severe winds often work great havoc with locusts swarms and at times completely annihilate them.

On two occasions cases like this have been noted, the first occurring in August, 1913. A swarm, flying from Bohol to Cebu, encountered a contrary wind, and, unable to continue against it, was forced to settle on the water and was drowned; for some days afterward the sea was completely covered with a brown crust or scum of these insects, those which were not eaten by fishes being washed ashore on the coast of Bohol where a windrow of dead locusts, nearly a meter high and a kilometer long, was finally deposited; the stench from this rotting mass made it almost impossible to stay in that vicinity.

A similar instance is recorded of a swarm of locusts which on or about May 20, 1913, started from the Island of Tablas, flying west in the direction of Mindoro; about half way to their destination contrary winds were met which forced them to alight on the sea, nearly the entire swarm being destroyed; for days after this, the beach in the vicinity of Concepcion, on the Island of Maestro del Campo, was deeply covered with dead locusts.

Rains.—The influence of rain is, in importance, about equal to that of winds. As in the case of high winds, locusts seldom fly during rains. When these two phenomena are combined in the form of a typhoon, the results are often disastrous to the swarm, many locusts being killed in large numbers by the vegetation being whipped about by the high wind, and also large numbers are drowned while the wings of the adult locusts are often torn to such an extent that further flight is impossible. When the latter occurrence takes place near the time of oviposition the gravid females are forced to lay their eggs on unsuitable ground which results in a very low percentage of them hatching.

Continued rains often produce floods which are of great importance as locust destroyers. The greatest efficiency in this connection is reached when large areas on which locusts have oviposited become flooded and quantities of silt are deposited over the eggs which effectually prevents the hoppers from emerging. It has also been observed, especially in the Province of Pangasinan, that wherever the eggs have been inundated for seven or more days a large proportion of them have been found to be dead and more or less decayed, this being especially true when incubation was advanced and the embryos were about to emerge.

Drought.—Drought seems to exert a powerful influence in the increase of the pest and it generally happens that a protracted drought will be followed by a period of heavy infestation. The effect of the continued dry weather is not so much of direct influence upon the locusts themselves, but it allows them to increase by removing the conditions which are favorable to the development of natural enemies; in other words, very dry weather is inimical to locust parasites.

Drought may also induce migrations due to lack of the proper food in a given locality.

FOOD SUPPLY.

As previously stated, the food supply of any insect in nature is largely determined by climatic conditions.

A lack of food might cause the migratory instinct to assert itself and the swarms to seek more congenial feeding grounds. Even if the food were adequate to sustain the locusts, their vitality might become lowered so that any other adverse factor would tend to decrease their numbers. Man has, to a certain degree, upset the balance of nature. His clearings are pushed farther and farther into waste lands, or locust zones, and he produces under artificial conditions crops which furnish the locusts with abundant food at a time when it may be most needed. In cultivation not only are large areas devoted to the same crop, but the plants are grown at seasons when food for the locusts is likely to be scarce on account of the burning over of cogonales, for example; this is especially true of those crops grown under irrigation.

ENEMIES.

Unfortunately very little time has been available to properly study this phase of the work; the influences which are herewith mentioned are only such as have been observed by the author while engaged in the field in the more important work of organizing the field forces.

Roughly speaking, locust enemies may be divided, according to their importance, into three classes: (1) Predators, (2) parasites, (3) diseases.

PREDATORS.

This class may be divided into five groups according to their importance: *Avian* (birds); *Mammalian* (animals); *Piscean* (fishes); and *Reptilian* (lizards, snakes, etc.).

Birds.—There are no natural enemies which attack the locust so persistently in all stages as birds. They often congregate where the locust swarms are and remain for days or weeks at the swarm eating their fill as often as they desire. Their importance as locust exterminators can not be too strongly emphasized. Unfortunately, many of our most persistent locust feeders are not wary in their habits and are ruthlessly snared whenever chance offers. Investigation of the value of birds as locust feeders are limited to cases where individuals have been taken and their stomach contents examined.

Twenty-four species of locust-eating birds have been identified, in the following families:

Turnicidæ (1).
Coracidæ (1).
Ardeidæ (2).
Falconidæ (3).
Artamidæ (1).
Phasianidæ (2).
Meropidæ (2).
Alcedinidæ (4).
Corvidæ (1).
Sylvidæ (2).
Fringillidæ (2).
Anatidæ (2).
Cuculidæ (1).

These species represent only a small number of the birds which have been observed but not taken for identification.

To this list may be added domestic poultry, all kinds of which feed with avidity on the pest at all stages.

Mammalian.—Bats and certain rodents, especially the field rats, mice, and shrews, devour considerable quantities of locusts. Also some of the large mammals, such as wild pigs, monkeys, etc., capture and destroy quite a number of locusts when a swarm visits their neighborhood. This is especially true of the wild pigs which have been noted, particularly in Mindanao, as devouring large numbers of immature locusts.

Reptilian.—Lizards and frogs of various kinds—and there are many—are almost entirely insectivorous and destroy large numbers of both the mature and young locusts.

Most of the small snakes are insectivorous, and when locusts are present feed upon them.

Piscean.—Various fish undoubtedly kill a certain amount of locusts, especially when the swarms (of hoppers) attempt to cross rivers or when migrating (as fliers) they are forced to settle upon the sea on account of contrary winds.

Predatory insects.—This class of enemies preys almost entirely on the immature insects and eggs, and includes Robber Flies (Asilidæ), Digger Wasps (Scoliidæ), Assassin Bugs (Reduviidæ), Tiger Beetles (Cicindelidæ), Ants (Formicidæ), and Mantis (Mantidæ).

Mites, scorpions, and centipedes might be added to this list, though they are not, strictly speaking, insects.

Ants are in all probability the most important of the predatory insects which attack locusts. They devour the pest in all stages. The small species, especially when fields in which locusts have oviposited have been plowed, destroy immense numbers of the eggs.

Observation of one species of these ants, believed to be *Solenopsis geminata,* was made at Bais, Oriental Negros. The locusts had laid eggs in a field planted with cane, and a few days later the field was plowed. In a surprisingly short time myriads of these small ants were noted feeding upon the locust eggs; in some instances the eggs were bitten into and the contents eaten, and in others the eggs were carried off to the adjacent nests. An examination of one of these nests showed the remains of several locust eggs. These and similar species attack and kill the hoppers, especially the very young ones and any that may be injured or weak.

The large red ants which build paper-like nests in trees and bushes have also been observed carrying the young hoppers up the tree trunks to the nest.

Predatory wasps (*Scoliidæ*).—A number of species of this family capture locusts to provision their nests, and in some countries are an important factor in controlling the pest.

Robber flies (*Asilidæ*).—These are very powerful flies which catch and devour other insects by sucking their juices. They are often numerous about the swarms of newly hatched locusts and undoubtedly destroy many.

Predatory Orthoptera (*Mantidæ*), *Hemiptera* (*Reduviidæ*), *and Coleoptera* (*Cicindelidæ.*)—Under these heads are the Assassin Bugs and the Mantis and Tiger Beetles.

All members of these families are predaceous and feed on various insects. While not of great economic importance, they do destroy considerable numbers of the hoppers, especially the young.

While not true insects, the following orders are in most cases included by the layman in this group: Scorpions, spiders, mites, and centipedes. With the exception of some mites, these, like the foregoing, are predaceous in their habits. Though they are not specific locust feeders, yet, with the exception of mites, they destroy many immature insects.

PARASITES.

In view of the very important part played by parasites in the control of insect outbreaks attention is naturally drawn to the possible parasites of the species under consideration.

Unfortunately very little time has been available for investigation along this line due to the press of routine work, though several parasites have been noted and some reared.

In reviewing the subject of parasitism it is evident that a parasite of the eggs of the locust that would act before the locusts could hatch would be the most effective. It is equally evident that parasites attacking the winged locust after it has done most of its damage are of lesser value.

Observations have thus far revealed six species which parasitize the plague locust, which, in order of importance, are as follows: Flies (3 species), nematode worms (2 species), and mites.

Flies.—The females deposit eggs or sometimes maggots upon the living locusts, usually one egg to each hopper. These make their way into the body cavity of the host where they feed on the soft tissues and do not attack the vital parts till they are fully developed, after which they work out of the locust and crawl into the ground to pupate, leaving the locust an empty shell.

Three families of this order, many of which are possible locust parasites, are present in the Philippines. They are: (1) Tachinidæ, (2) Sarcophagidæ, (3) Dexidæ.

Individuals of the first two groups have been reared; the latter have merely been noted in the vicinity of swarms, but have never been "bred out."

Entomologists of other countries report that the tachinids confine their operations in most cases to the winged locusts. It is yet early to state positively whether the Philippine forms conform to this habit or oviposit in both stages, as sufficient time has not been available to determine this.

The sarcophagids are known to parasitize both the mature and young locusts. The family is a large one and well represented in the Philippines.

The first specimens of parasite locust flies reared were from locusts taken at Cabanatuan, Nueva Ecija. Since then numbers of them have been bred from locusts from other districts. The flies which emerged were a common species fairly abundant around stables and known to oviposit on various kinds of matter.

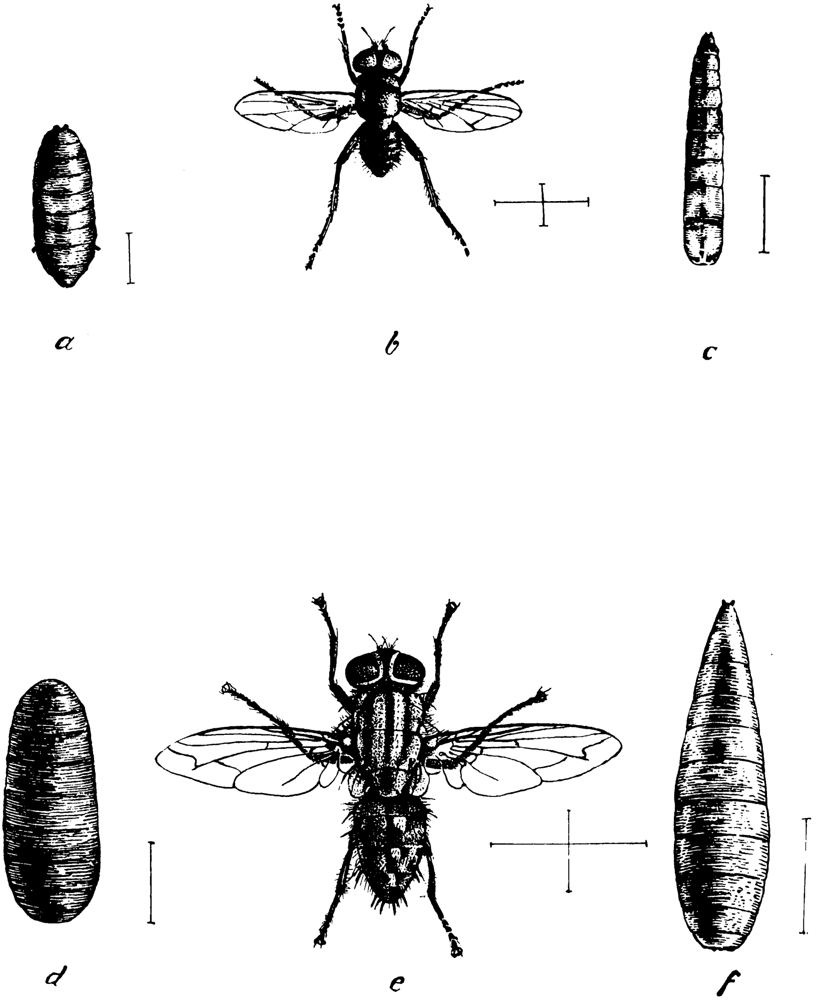
In several instances, where locust hoppers were being destroyed by the pit method, this species was noted as fairly prevalent and several times was seen ovipositing. The fly alighted on the small hopper and, straddling its back, despite the struggles of the hopper, succeeded in depositing an egg on the upper side of the second segment of the abdomen.

The full-grown larva of this fly (Plate IV) is nearly 2 centimeters long and grayish in color. Specimens which emerged from locusts spent sixteen days in the pupal stage. The most striking feature of these flies is the eyes which are large and reddish; the wings are clear with dark veins, while the body, especially the abdomen, is of a mottled light silvery color and is covered with black hairs.

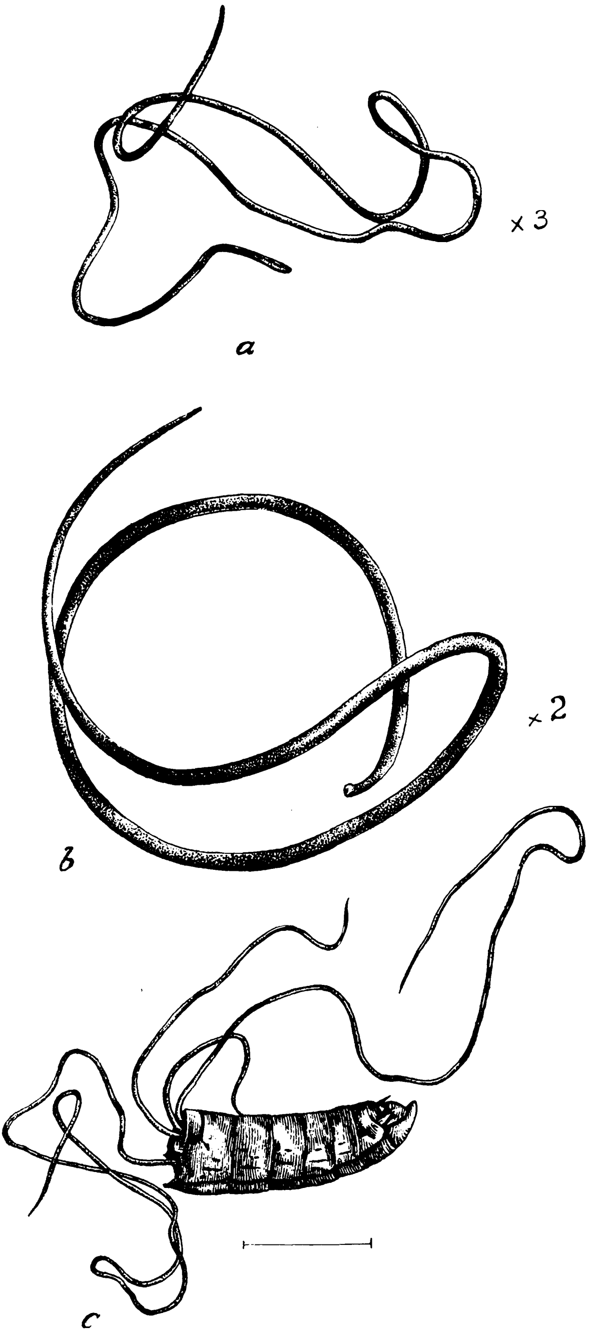
The number of parasitized individuals never exceeded 6 per cent in our observations.

Unfortunately, individuals of this family are frequently attacked by the predaceous asilids which seem to prefer them to the hoppers.

Another species was a small fly of a brilliant metallic black color covered with numerous black hairs. This is apparently a tachinid and is the most abundant of the locust flies yet noted. The first specimens were bred from locusts taken in Nueva Ecija Province. Large numbers of them have been reared from winged locusts and an examination of 500 adult locusts showed that 17 per cent of them contained the maggots. As far as numbers go, it greatly exceeds those of other species reared, though fur-



Dipterous parasites of locusts: (*a*) Pupa of smaller locust fly; (*b*) adult; (*c*) larva; (*d*) pupa of large locust fly; (*e*) adult; (*f*) larva.



Nematode locust parasites: (*a*) Adult *Mermis* spp.; (*b*) adult *Gordius* spp.; (*c*) abdomen of locust showing nematode parasites.

ther investigation will be necessary to establish the economic importance of the species.

A single individual of a larger species of apparently the same family was reared. It closely resembles the preceding but is larger and lacks the bright metallic luster.

Hair worms.—Nematodes, or hair worms, as they are commonly called, infest many forms of insect life where they are found coiled up in the body cavity (Plate V).

Two species representing the two genera, *Gordius* and *Mermis,* have been taken from the Philippine locusts.

These parasites differ in habits, the former breeding in water while the latter is terrestrial.

While the life history of the Philippine forms is not definitely known, it is presumably the same as in other countries, the eggs being deposited in water, and the young, which are microscopic, crawling up on vegetation and reaching the host through the mouth with food; it undergoes its transformation in the body cavity of the locust and finally emerges through the anal segment.

The life cycle of *Mermis* is passed in much the same manner save that the eggs are laid in the ground instead of water. Individuals of *Gordius* are much larger than those of *Mermis,* the former being often 25 to 30 centimeters in length while the latter are shorter and more fragile.

It has been reported that whole swarms of locusts have been destroyed by these parasites in Negros, though reliable evidence confirming this information is lacking.

Our examinations of locusts infested with this class of parasites showed the highest percentage of parasitized individuals to be 7 per cent. In some cases as high as six parasites have been found in one locust.

Examination of gravid females often revealed parasitism by this species. The host seemed to suffer no great inconvenience from the presence of the parasite and every indication pointed to the fact that the locust would complete the function of oviposition in the normal manner.

It seems to be the consensus of opinion of the entomologists of other countries who have studied these parasites that as far as can be learned they are of little economic importance as locust destroyers.

Mites.—Mites seem to be present wherever locusts are found and are quite common in the Philippines.

While the life history and habits of our Philippine locust mites, *Trombidium,* has not been thoroughly studied, yet, according to American authorities, they are among the most interesting of locust parasites.

The young mites which are six-legged are bright red in color. They climb up on the grass stems and crawl on the locust finally attaching themselves to the wings or some other protected part. Here they remain attached and suck up nourishment until the body swells, and after becoming full fed they drop off, undergo their metamorphosis and emerge as perfect eight-legged mites. During the adult stage they feed upon locust eggs until the completion of the life cycle.

These red locust mites are not uncommon on our Philippine plague locust. As far as is now known they are no great inconvenience to their hosts. Future investigation may add greatly to our knowledge of their economic importance.

In summing up the various parasites which affect the Philippine locust we find that, though varied, the percentage of parasitized individuals is small.

When considering that to completely control any pest it is necessary that the percentage killed by parasites, etc., must be *over 95 per cent* it is seen that the possibility of controlling locusts through this agency is very remote.

DISEASES.

It sometimes happens that with the right meteorological conditions large numbers of plant pests are destroyed through the agency of fungus of bacterial diseases.

At times they propagate and destroy locusts in their various stages, but they are dependant upon climatic conditions which can not be controlled by man.

Along these lines two organisms have come to notice: *Empusa grylli,* a fungus, and *Coccobacillus acridiorum,* a bacillus.

The former has been noted in the Islands, probably being indigenous, and doubtless destroys many locusts. The dead locusts hanging to blades of grass have been seen by the author in several provinces, the habit of infected locusts of seeking the light being characteristic of this disease. Prof. Lawrence Bruner of the University of Nebraska states that he noticed it in Laguna Province during the month of October, 1913. Unfortunately, it is impossible to cultivate this fungi with much success artificially and communicate it to locust swarms; while it can be handled to a limited extent in the laboratory where all conditions can be controlled, out of doors it has thus far failed to bring about the desired results.

A few years ago a new cocobacillus *Coccobacillus acridiorum* was discovered by D'Herelle in Mexico which was said to be fatal to locusts and harmless to other forms of animal life and for which a very bright future was predicted; reports published in various South American agricultural journals commented favorably on the results obtained.

Cultures of the disease were obtained from Argentina and under the direction of Doctor Barber, of the Bureau of Science, were brought to their maximum virulency in the laboratory, after which a through test was made under actual field condition on a swarm of half-grown locusts. Every possible precaution was taken and climatic conditions were ideal, the weather being warm and humid. Despite the high degree of virulency obtained under laboratory conditions, the results were practically nil. A few hoppers were found dead, but there was no evidence of the contagion spreading as was hoped.

An interesting article by Lounsbury in the South African Agricultural Journal for April, 1913, describes experiments with this disease on a nonmigratory locust which was very destructive in the Daspoort Gardens near Pretoria; the results obtained were virtually the same as those obtained in the Philippines. The following is quoted from this article:

> It appears to me in the light of the experience gained and from the information given by the Pasteur Institute that the disease at best can be used only as a supplementary measure in dealing with an invasion of locusts under the conditions which prevail in South Africa.

From information available it would seem that the possibility of employing parasites or diseases artificially in the destruction of locusts *is small* since they require conditions which are beyond our control.

During normal years locusts are held in check by the abovementioned natural agencies. During abnormal seasons, when any of these factors are temporarily absent, we must rely upon our own efforts to control them.

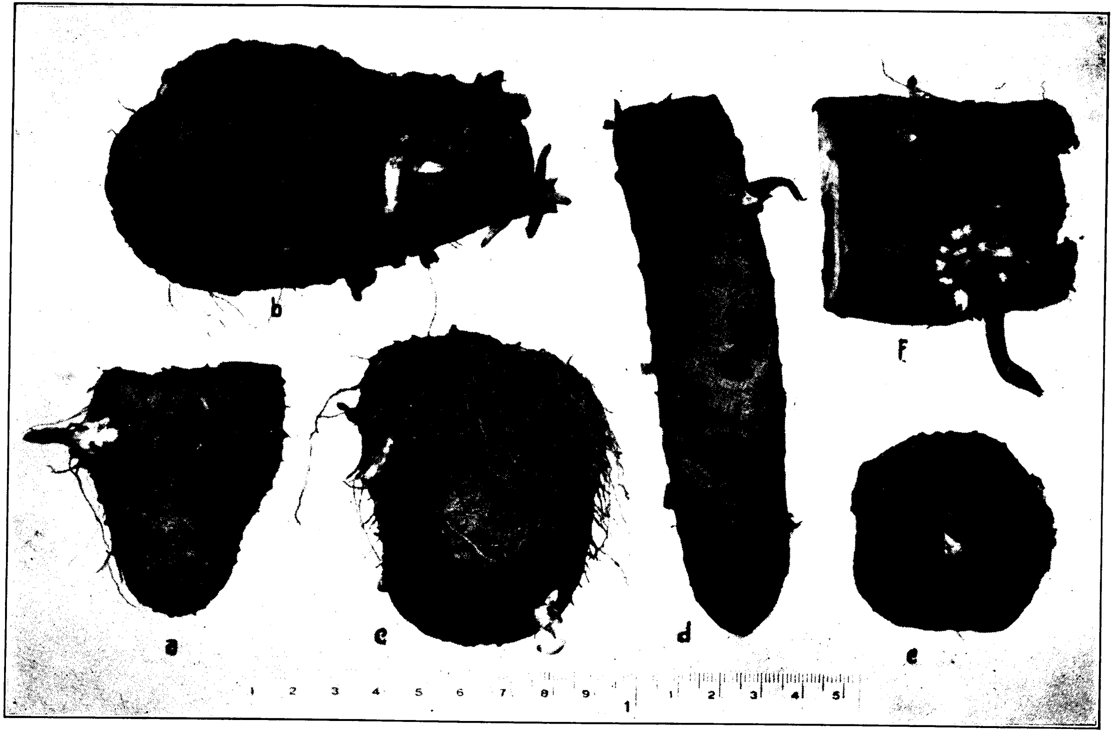
ADVENTITIOUS GERMINATION IN DIOSCOREACEÆ.

By P. J. WESTER, *Horticulturist in Charge of the Lamao Experiment Station.*

It is a commonly accepted fact that when a plant is propagated vegetatively—that is, by means of the division of any part of the orginal plants, by tuber, root or stem cuttings, budding, etc.—in order to be capable of growing into plants the severed parts must have at least one "eye" or bud from which to form leaves and stems. A potato, for instance, to use a familiar case as an illustration, cannot germinate and grow into a plant if the "eyes" are removed; likewise in the case of certain exogenous plants, like the avocado, a bud may successfully "take" and make a perfect union with the stock, but if the leaf bud itself together with all leaf scales have been broken off or dropped the bud can never send forth any plant tissue; to use a horticultural term, it is "blind."

However, a few plants are exempt from this rule and have the peculiar and hitherto inexplicable power of spontaneously developing germinative tissue from which leaves and stems grow. Thus the leaves of the sansevierias and begonias may be cut into pieces, which are inserted in the soil like cuttings.

The ube (*Dioscorea alata* L.) is quite an important root crop in many districts of the Philippines. The proximal end of the tubers are saved for "seed" by the people as they are eaten, and planted during March and April, and it is commonly believed that the rest of the tuber is incapable of making any growth. However, the writer made observations to the contrary with the same species in Florida several years ago, and in order to determine if this peculiarity of *D. alata* extended to other species, the distal end of tubers of the following species were cut off in March and kept under observation at the Lamao experiment station: *Dioscorea alata* L., D. *aculeata* var. *tiliæfolia* Prain and Burkill, *D. triphylla* L., *D. pentaphylla L.*, and *Smilax sandwicensis.* In due time every one of these tubers germinated and developed into healthy vigorous plants after being set out in the field (Plate VI).



Distal ends of tubers of the *Dioscoreaceæ* showing germination: (*a*) *D. pentaphylla* L.; (*b*) and (*c*) *D. aculeata* var. *tiliaefolia* Prain and Burkhill; (*d*) and (*e*) *D. alata* L.; (*f*) *Smilax sandwicensis.*

While interesting to the student in morphology, the above fact is of great practical value to the grower of the above-mentioned plants. Thus a good-sized tuber of the ube may be cut into 6 or more parts for "seed," according to size. In those parts of the Islands where the rainy season coincides with or occurs shortly after the time of planting the tubers, these should be kept in a dry place in the shade until they have germinated and then planted, for otherwise they are apt to decay before germination takes place. This does not, of course, apply to the proximal end of the tuber which is well provided with buds that start promptly.

In this connection it may be of interest to know that if a tender seedling of *Annona cherimolia* Mill., *Rollinia orthopetala* A. DC., or *Uvaria rufa* Bl., is broken off below the cotyledons, germinative tissue will develop from the remaining budless stump if the plant is in good condition. This fact probably holds true in many other plants belonging to the same genera.

PERFORMANCE AND THE SCORE CARD.

By H. O. JACOBSON, *Agricultural Inspector.*

With the inauguration of the corn shows came the score card in a new application. The score card had become a familiar feature of live-stock exhibitions, but its use in grain judging was a decided innovation.

The writer recalls the introduction of the maize score card into the curriculum of the agronomy studies and it caused a great deal of speculation among the students at that time. To us it was a foregone conclusion that maize was maize and the biggest was unquestionably the best *per se.* Following the maize score card came cards for barley, wheat, oats, and rye.

The use of the score card is an invaluable aid to the student in training his faculty for observation, but he frequently fails to realize its relative value, and it may deprive the observer of a proper perspective of the problem in hand.

It is safe to say that in the last decade too much emphasis has been placed upon seed selection by the score card, both by the agricultural press and instructors in the elementary agricultural schools. Sufficient stress has not been laid upon the fundamental principles governing seed improvement, resulting in considerable confusion among farmers and prospective maize breeders.

The values of the score card are arbitrary and are established on premises based somewhat more on theory than on facts supported by proof.

It is supposed to represent a model of perfection and is intended to serve as a standard by which results are gauged rather than a guide for the direction of the breeder.

All the problems of the maize breeder have a direct relation to their economic values. Maize has no other than a utilitarian value. The relative value of any variety or strain of maize is always in direct proportion to its capacity for performance or yield of shelled maize.

Yield or performance is therefore the object sought which must ever be kept in view and all other features must be subsidiary to it.

If the score card is to serve as a guide for seed selection, then each point upon which an ear is judged should bear some association or be a correlative factor to yield.

Unfortunately, this is the weakness of the maize score card in common with all other mechanical means for measuring invisible characteristics.

Pearl says, in Bulletin 183, Maine Experiment Station:

> Two years' ear-to-the-row tests furnish no evidence that there is any close association or correlation between the size or conformation of the seed ear and the *yield* of maize obtained from it upon planting. The large, well tipped, and beautifully shaped ear is as likely as not to prove a poor yielder when planted. This result means that the external, visible characteristics of the ear are a very unreliable indication of its probable worth for seed purposes * * *.

The score card has but a limited scope and necessarily deals only with the visible characteristics of the ear. A prominent Indiana maize breeder paid ₱200 for the sweep-stakes ear at a big exhibition. When planted, this ear did not yield quite as much as the average secured in the field of common seed grown for feeding purposes.

Countless numbers of amateur maize breeders placing their sole reliance on the dictum of the score card have painstakingly selected their seed, only to be disappointed in yield. When field selection has been resorted to, more satisfactory results have been obtained, even though falling considerably short of results hoped for.

We will briefly consider two points on the score card as to their possible values as indices for performance.

SHAPE OF EAR.

A perfect ear, according to most score cards, should be cylindrical. Some few varieties are allowed to have a very slightly tapering shape. Calculated on a geometrical basis, a cylindrical ear should carry a larger net weight of kernels and logically this shape ought to be a reliable index for high production, because if like produces like, the progeny should be cylindrical and carry more grain than the progeny of a tapering ear. Experimentation is perhaps insufficient to definitely answer this question, but results so far secured suggest that this point has little value in indicating potential efficiency in production.

Williams, at the Ohio Experiment Station, in 18 tests found that the tapering seed ears yielded 0.87 bushel per acre more than the cylindrical ears.

Webber, at Cornell University, found no difference in yield in comparing the performance of the two shapes in seed ears.

TIPS OF EARS.

Williams also compared the performance of seed ears with bare tips with those having well-filled tips. A gain of only 1.07 bushels per acre, or slightly over 2 per cent, was found in favor of seed ears with well-filled tips.

Respecting this feature in seed ears it should be remembered that failure to cover the tip with kernels is frequently due to unfavorable climatic conditions which prevent fertilization of the embryo and is in itself not strictly a heritable characteristic.

Tests with reference to number of rows of kernels, percentage of shelled maize, and weight and length of ear do not indicate positively that any of these characters can be associated with yield with any degree of constancy.

But when the factor for performance has been established for the progeny of an ear or a number of ears, the score card may be brought into use in order to assemble the new lot of seed ears conforming to one standard in external characteristics. Let us be consistent in our judgment. When we discard an ear because of this defect or the other, let us do so on the grounds of unsightliness and not on the strength of the hypothetical argument that such and such an ear will probably not yield well.

The failure to recognize individuality in our grain plants has hindered progress in the direction of improvement in both quality and yield. It has been customary to regard plants as populations, thereby entirely overlooking the superior individuals, but this fallacy in thought and practice is now being corrected.

Promiscuous selection of seed maize has probably never resulted in increased yield except by accident. The early maize breeders of the United States, while they did not practice the methods in vogue at present, certainly did recognize the individuality of the maize plants and selected the seed afield in most instances. It naturally followed that where sufficient interest was aroused to select seed with care, environmental conditions were also improved.

It should be clearly recognized that judging seed maize by the score card is merely assembling to a given standard in visible characteristics and that these visible characteristics do not necessarily bear any relation to productivity. Uniformity in external characteristics is desirable and valuable but is always subordinate to performance.

At present there is no other way of testing the performance of an ear of seed maize other than that of actually planting a portion of its kernels and making observations on its growth and production. The scales eventually tell the story.

An error which many a breeder has fallen into is that of being led away from the main object in view by unconsciously attaching too much importance to some minor characteristic. Such things are common enough among live-stock breeders.

In maize it has happened that in the effort to secure an abnormally large percentage of grain to cob, the yield has receded to a very nominal figure. Yet it is common knowledge among maize breeders that few highly productive varieties exceed 85 per cent of shelled grain. The writer has never found a highly productive mother ear that would shell out a high percentage of grain.

While the following has no direct reference to the score card, it concerns advice that is frequently unqualifiedly given as bearing a direct relation to yield—the theory regarding prolificacy of ears in maize. The argument, threadbare with discussion, that a stalk with two ears is more profitable than one having but a single ear is logical theoretically, but it has not yet been proved as a fact in practice. As a matter of record the notably prolific varieties have so far failed utterly to maintain a creditable position in point of yield with the single-eared varieties. The production of grain depends in a large measure on the environmental conditions, such as plant food, water, temperature, sunshine, etc. If these are not present sufficiently to produce one good ear per stalk it certainly is folly to try to produce two. Therefore it is inconsistent to select seed of a multi-eared variety unless the soil is unusually fertile.

A number of years ago the writer secured some seed of a multi-eared variety known as Iowa Gold Mine. This strain, producing from two to nine ears per stalk, was planted side by side with a standard single-eared variety on heavily fertilized soil. While it produced a large number of ears, the yield fell 33 per cent below that of the single-eared variety. On moderately fertile soil the yield was very poor indeed, since most of the ears were rudimentary and poorly developed.

The Minnesota Experiment Station, after a number of years' work in attempting to place a multi-eared variety in the first rank in productivity, discontinued the experiment, declaring that prolificacy in ears as a varietal characteristic was of insufficient practical value to receive special consideration.

When selecting seed in the field, pick those ears which conform to your idea of excellence regardless of the number of ears the stalk carries, and when testing the productivity of seed ears select those which come off the high-yielding rows irrespective of the multi-ear theory. In the end you will have a more satisfactory result if you confine your attention to a single purpose.

AGRICULTURAL CONDITIONS IN THE SUBPROVINCE OF BONTOC.

By A. M. BURTON, *Agricultural Inspector.*

Bontoc, a subprovince of the Mountain Province, is located in the north-central part of Luzon. On account of the mountainous character of the subprovince there is not a great deal of arable land, but the Igorots utilize every foot which can be used for crop production. Their terraced and irrigated hillsides which are planted to rice are remarkable examples of engineering work and show that the Igorots possess a degree of engineering skill beyond what might be expected of a people in their stage of civilization.

Rice and camotes are the two crops most extensively grown in the subprovince and constitute the main diet of the Igorot. Neither rice nor camotes are exported.

Maize has been widely distributed over the subprovince by the Bureau of Agriculture and has thrived under Bontoc conditions. It is expected that maize will eventually become one of the more important crops of Bontoc.

Some tobacco of fairly good grade is raised in the northern part of the subprovince. This tobacco is all consumed locally.

Sugar cane is grown throughout the subprovince, but only in small quantities. It is all used locally in the manufacture of "basi," a native alcoholic drink.

Coffee is grown in small quantities, principally in Bontoc and Sagada townships. The coffee raised is of good quality, but is a rather uncertain crop on account of the danger from typhoons and disease. About 50,000 seedlings have been distributed from the Bontoc jail garden during the past year. These have all been planted in small individual plots around the homes of the people. Even though these trees may eventually succumb to the blight, observation of the older trees now growing indicates that the new trees should bear several crops, enough to pay a generous profit over the cost of planting, care, and harvesting, before succumbing. Plantings of Liberian coffee, which is more blight resistant than the native varieties, have been made in some of the townships in the lower altitudes.

Quite a variety of vegetables not indigenous to this country have been grown in the subprovince of Bontoc under the supervision of the Bureau of Agriculture and many of them, such as peas, beans, radishes, turnips, lettuce, cabbage, beets, onions, pechay, cucumbers, American sweet potatoes, tomatoes, eggplants, and peppers, have proved so satisfactory as to create quite a demand for their more extensive distribution in the future.

Papaya did exceedingly well in Bontoc and plantings of papaya are now being made in many sections of the subprovince.

There are no data available regarding the number of cattle raised in the subprovince as most of the animals are wild, not having been corralled, and have not been branded. Steps were taken last year in the matter of branding the larger animals which are now being branded and registered as rapidly as they can be caught. There are more carabao than cattle in the subprovince.

Quite a number of pigs are raised in Bontoc, each house owner having from one to three animals.

There are 282 kilometers of roads and trails in the subprovince of which 44 kilometers are cart trail, 157 kilometers horse trail with a maximum grade of 6 per cent, and 81 kilometers horse trail of high grade.

An improvement completed during the last fiscal year is an irrigation ditch 3 kilometers in length which irrigates approximately 16 hectares of rice land in the town of Bontoc. The first crop from this newly irrigated land was harvested in June, 1913.

Another important project which will probably be undertaken this year is the construction of a ditch which will irrigate approximately 20 hectares in the town of Tucucan.

There are several forests of pine in the subprovince. A saw and shingle mill is operated at Fidelizan in the township of Sagada.

Excellent pottery clay is found in the town of Samoki and quite a number of Igorots make jars of this clay which they sell throughout the subprovince.

A superior grade of brick clay and building stone is found in the town of Bontoc and both have been utilized in the construction of the government buildings there.

EXPLORATION TRIP INTO THE INTERIOR OF CATANDUANES ISLAND, ALBAY, P. I.

By E. H. KOERT, *Superintendent of Breeding Work on Catanduanes Island.*

On July 31, 1913, a party, organized by the writer, left Virac to make an exploration of the interior of the Island of Catanduanes with respect to possible future agricultural development. The party consisted of two Filipino woodsmen, seven bearers, Mr. P. N. Sturtevant (the local head teacher), and the undersigned.

Leaving Virac about 9.30 a. m., the party proceeded to the Bicol farm, jointly maintained by the subprovince of Catanduanes and the Bureau of Agriculture; thence along the valley of the Pajo River to the barrio of Buyo where a short stop was made for lunch; in the afternoon the channel of the Pajo River was followed to the "visita"[1] of Dugui (mud), the last outpost of civilization, arriving there about 5 p. m. In both Buyo and Dugui a considerable number of people showed traces of a blood different from that of the Filipino, bearing out a statement made by the writer on another occasion of the presence of a foreign strain of blood among the inhabitants of Catanduanes Island.

Dugui is the last place inhabited; further in the interior not even a single house is to be found. It is a typical Catanduanes pioneer settlement. On the land around their houses the people have plats of camotes, vegetables, maize, and a little sugar cane; on the near-by hillsides their abacá plantings are seen, with a few coconut trees here and there. During the time it takes for their abacá and coconuts to become productive they supply their "store necessities" with the proceeds received for rattan and other forest products gathered.

Shortly before arriving at Dugui a ridge is noted, running at right angles to the Pajo River. Prior to the time that the river forced a channel through this ridge, the three valleys, formed by the three rivers which unite in the Pajo River, no doubt were the bottom lands near Dugui; the name Dugui (mud) doubtless originated from this. The narrow channel through the ridge has probably been closed at times by boulders and other obstructions, and when the dam was finally broken by the force of the water, the accumulation of gravel was evidently carried out upon the lowlands of Virac, thus forming the various strata.

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[1] An outlying group of houses.

Near Dugui a large, well-formed tree was noted, loaded down with a large plum-like fruit, locally known as "lubas." Upon inquiry it was found that the Filipinos use the leaves and fruit of this tree extensively in cooking. The latter was found to be quite acid. Later on during the trip another tree was found with the fruit much sweeter. On the return to Virac a quantity of this fruit was secured, and plum butter of a very fine flavor made, greatly relished by a considerable number of people who had occasion to try it.

Early in the morning of August 1 the party left Dugui, and following the channel of a small creek to its headwaters, continued up the ridge from which it rises, this ridge being found to be an outrunner of Mount Bulan, our objective point. About 3 p. m. an elevation of some 600 meters was reached, and camp was made along the headwaters of one of the branches of the Pajo River.

During the day no discoveries worth mentioning were made, the route having been principally along a stony ridge, following the trails of the wild pig which abounds in that locality.

The night of August 1 was spent somewhat uncomfortably, as the hastily constructed shelter of the afternoon before was not sufficient to keep out the heavy downpour of rain experienced during the night.

The rainfall just below the top of Mount Bulan appears to be exceptionally heavy. Thunder was heard practically at all times.

On the 2d of August the party continued. After a sharp climb for about 150 meters a gently sloping mountain side was reached. The timber here was of a dwarf type, with white oak abounding, intermingled with karagomoy and various species of the rattan family. In this locality wild chickens and deer were seen in great numbers. Several of the latter were secured during the two days on the mountain.

Fifteen minutes later we reached the top of Mount Bulan. Without doubt the members of our party were the first Caucasians to reach the interior of Catanduanes, but it must be admitted that signs were found of others having been there before, and no doubt a settlement of *remontados*[1] will be found in the valley to the north of Mount Bulan. A fine view of the greater part of the Island of Catanduanes was obtainable from here. (Fig. 1.)

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[1] Mountain people, usually criminals or those unwilling to live in civilized communities.

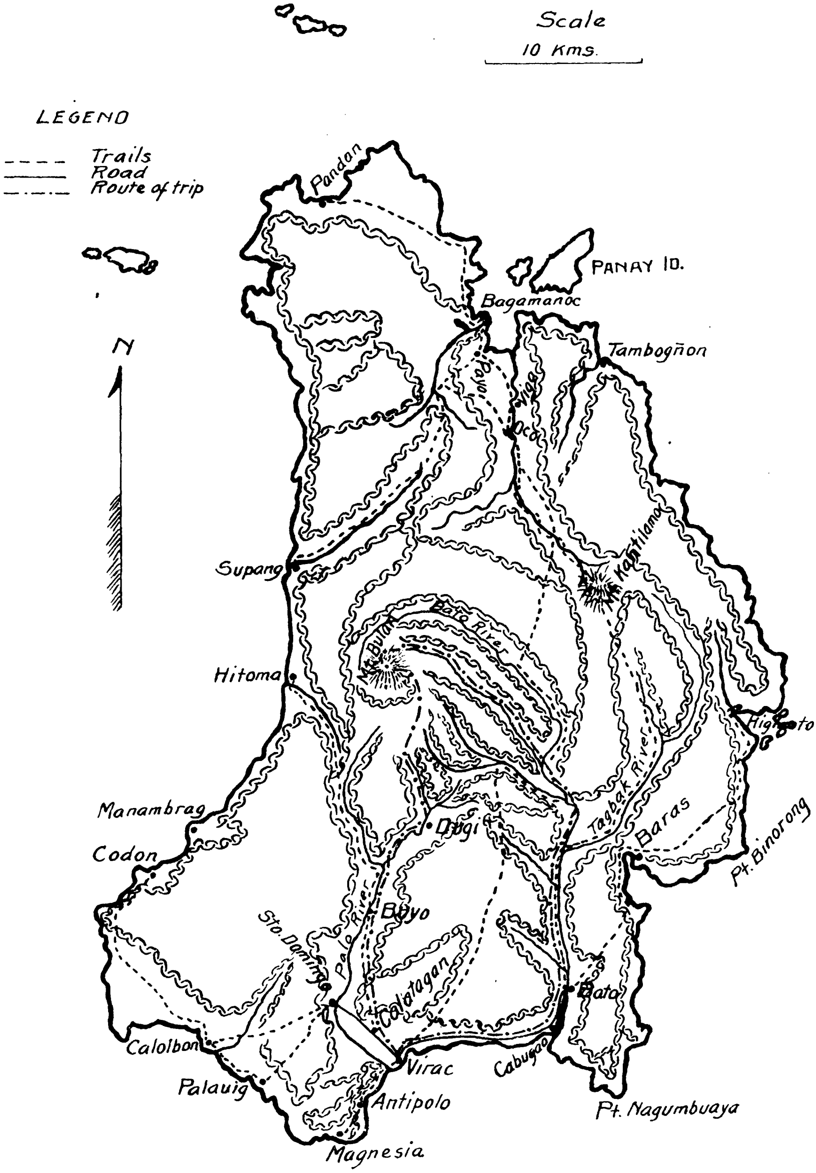

Fig. 1.

The top of the mountain is a plateau overgrown with what is known as gajo, a reedy grass. The formation appears to be mostly iron. This was verified Monday morning by making a closer examination along the bed of the creek where camp was made. The intention had been to descend the mountain on the north side, but this appeared to be impossible, the mountain making a sheer drop. Accordingly, early Monday morning the party started to return to Virac, following the course of the brook where camp had been made.

While descending, a waterfall had to be avoided which a conservative estimate would place at not less than 120 meters in height. A good deal of difficulty was encountered upon reaching the north to south ridge of the island previously mentioned, and which appears to cross all rivers with a southern outlet more or less at right angles. The channel of the river which the party was following (the Caglatauan) at this place was very narrow, and could not be forded; an attempt resulted in the man trying it having to swim in the ice-cold water. The rest of the party accomplished the passage by clinging to roots and trees, and thus eventually reached the river at the farther side of the cross ridge.

From the knowledge acquired by the writer in several trips into the interior of the conditions of the Himigman, Caglatauan (where the alligator abounds), and the Bato Rivers, it is safe to predict that if these rivers should happen to be dammed during a baguio, the sudden breaking of this dam would wipe out the entire valley of the Bato River. The means to prevent this are simple and comparatively inexpensive; a few charges of dynamite, judiciously placed, would remove this danger.

On the afternoon of August 4 camp was made early on the Caglatauan, some 180 meters above its junction with the Bato River.

The balance of the day was spent in the collection of plants and fruits; the following is a list of those secured:

A flat brown nut, locally known as "bulagun."

A fruit similar to the chestnut known as "barobu" or "malbuo."

A fruit the size of a hazlenut used as salad, and known as "llaiuan."

A large square fruit, very sweet, known as "birian."

A small oval fruit, both sweet and sour, known as "tublun."

A fruit similar to but smaller than the santol, known as "alauihau."

A plumlike fruit, some sour, some sweet, known as "lubas."

A small oblong berry, red in color and greatly liked by the monkeys, sometimes called "uayog."

An unnamed berry, similar to the above, but more cherrylike, yellow in color.

A small berry used by the people when buyo is not procurable.

An unknown brown tuber.

A considerable number of specimens were collected, but many of these have failed to grow; however, it is likely that most of these can be secured near by. Conditions at the Bicol farm will be more favorable in the future to assure the continued growth of the forest products that may be collected.

On August 5 the return to Virac was accomplished. At the junction of the Caglatauan and Bato Rivers a number of rapids have to be forded which are quite dangerous, and a deep stretch of water is encountered. About an hour's travel below this place is the junction of the Bato River with the Himigminan, meaning wetstone, from a peculiar kind of rock found in this place. Another hour's travel brought the party to the junction of the Bato River with the Tagbac River and the Virac to Viga trail. From here on it is some 24 kilometers into Virac.

From indications it would appear that a trip up the Bato River is necessary for the following reasons: First to locate the habitations of the *remontados* which probably are at or near its source; second, to make a collection of the plants that are to be found in the large valley formed by it and also to visit the large patches of wild hemp that are known to be along this river. The object of the trip already made was in part to secure this collection, although it could not be accomplished on account of not being able to descend Mount Bulan on the north.

CURRENT NOTES—NOVEMBER.

NOTES BY O. W. BARRETT, Chief, Division of Horticulture.

DUTCH EAST INDIES COPRA.

The present output of copra in the Dutch East Indies is some 150,000 against 115,000 tons for the Philippines. Java and Madura are now exporting about 100,000 tons of medium-grade copra per annum, while Celebes produces in the neighborhood of 40,000. The normal Philippine output is about 170,000 tons. Sumatra thus far has produced very little copra, but several European companies are planting up large areas and according to the Daily Consular and Trade Reports fully 4,000 hectares are in young coconuts.

A German company has taken up a large block of land on the west coast of Celebes and gradually this crop is receiving more attention and extending itself throughout the eastern section of Netherlands Indies. Wherefore we must conclude that unless Filipino planters bend every effort to the extension of the industry in the Philippines there is no question but that in a few years Dutch East Indies will far exceed the Philippines in copra production.

A NEW COCONUT HUSKER.

We learn from the Daily Consular and Trade Reports that considerable interest has lately been aroused in a German machine for husking coconuts. This machine, which costs about ₱125—

consists of two sets of cone anvil cutters, arranged one above the other, each consisting of three radially placed blades, of which the lower cutter may be adjusted vertically by a lever and can be adjusted to prevent it from turning, whereas the upper one is worked by a handwheel. The coconut is placed point uppermost between the blades, and then the lower cutter is pressed upwards by setting the foot on the counterweights. This causes the blades, which are exactly opposite to one another, to cut into the layer of fiber as far as the hard shell. By causing the upper cutter to revolve by the handwheel, the entire layer of fiber is divided into three long longitudinal segments which can then be easily removed by hand. This process does not present the slightest difficulty with fresh coconuts, so that a skilled workman can remove the fiber from as many as 100 nuts an hour.

Conservatively speaking, however, we can hardly feel greatly encouraged over the prophesied success of this machine for the simple reason that an experienced Filipino husker will finish 2 to 4 nuts per minute, which is to say at least 125 nuts per hour; obviously, therefore, this machine would have to do three or four times as much work in a given time as the average laborer would do in order to win favor in this country. (Possibly the above-quoted notice should read "1,000 nuts per hour" instead of "100"—the writer having seen in Zambesia, East Africa, a machine, operated by four men, that was capable of partially husking about 1,000 nuts per hour *when not laid up for repairs.*)

A NEW BOOK ON THE BANANA.

We learn from the Agricultural News of Barbados that a book on banana culture is being published by Wm. Fawcett, esq., ex-director of public gardens and plantations at Kingston, Jamaica. The banana crop is steadily increasing in importance throughout tropical America and this book written in the very center of the trade region of this crop should be highly authoritative. It should be remembered that there are now 130 specially constructed banana steamers handling the 60 million or more bunches of the so-called "Jamaica" banana per annum. Jamaica alone produces 17 million bunches per year and the United States consumes over 40 million bunches.

A review of all the species of bananas, wild and cultivated, together with interesting notes of botanical and horticultural interest will be included, it is understood, in this forthcoming publication. It will be interesting to note just what opinions Mr. Fawcett will express concerning Schumann's 42 species as given in Engler's monograph. By the way, a French tropical-agriculture publication has recently announced that there are 196 species and varieties of banana known at present. (The Bureau of Agriculture collection contains well over 300 numbers and it is probable that fully 100, if not 200 *more* varieties can be obtained, if all goes well, within one year.

The tropical planters in both hemispheres will warmly welcome any practical work on this exceedingly important, but thus far unpopular crop in the Philippines; for we all are beginning to realize the prominent part the banana is going to play in tropical agriculture in the future.

ARGENTINE EXPERIMENTAL FARMS.

Seven new experimental farms have just been established in the Province of San Juan, Argentina.

Both the Argentine Republic and Brazil are rapidly extending their lines of action in the way of demonstration farms and experiment stations. Several experts from America and Europe have recently been appointed to high positions as advisors or instructors in this line of work. The northern part of Argentina, where subtropical conditions exist, is developing rapidly and the entire valley of the Rio de la Plata is becoming transformed into a vast domain of modern agricultural development. Great as is this valley, however, it hardly compares with that of the Amazon which is considerably the largest in the world—covering an area of some 7 million square kilometers (about 2,500,000 square miles). The total area of the Philippine Islands is under 300,000 square kilometers (about 114,500 square miles), or only about one-twenty-third the area of the Amazonas watershed.

A NEW COLLEGE OF AGRICULTURE.

The Republic of Guatemala has established a college of agriculture to satisfy the rapidly increasing demand for technical education in the agricultural sciences. President Estrada Cabrera founded the institute on January 13, 1913, at Guatemala City. There is no doubt that, as the Bulletin of the Pan-American Union prophesies, "from henceforth the influence of the school of agriculture will be a prominent feature in the development of the immense and varied agricultural resources of the country."

A RIVAL TO THE PANAMA EXPOSITION.

We learn from the Bulletin of the Pan-American Union for April, 1913, that the Republic of Panama has introduced a bill into the Congress of Panama to authorize the executive bureau to invest ₱500,000 "for the celebration in 1915 of a national exposition." A smaller sum has actually been put at the "disposal of the President of the Republic to celebrate the discovery of the Pacific by Balboa in 1513, but President Porres recommended that this be increased to ₱500,000 so that the event could be celebrated on a larger scale and in a more fitting manner." If this sum of money is expended in old Panama City in celebrating the discovery of the Pacific it may in some ways cause more or less confusion in the minds of European and oriental countries, occurring as it would simultaneously with the Panama Exposition at San Francisco. It is understood that the Panama Government purposes to invite participation in the exposition by all the governments of the Western Hemisphere, besides a number of the European countries.

QUININE FACTORY.

A new factory at Bandoeng, Java, is very actively engaged in filling orders "direct to dealers" for drug preparations of quinine freshly made right in the heart of the greatest quinine-producing district of the world. Shipments of the crude bark to the United States continue, of course, and for the year 1912 amount to nearly 10,000 tons. In this connection it is of interest to remember that the Dutch chemists, by the application of modern scientific methods of plant breeding, have increased the quinine content of certain varieties of cinchona under cultivation in Java from 7 to 15 per cent.

CHICLE OUTPUT.

It seems hardly credible that the present consumption of chicle in the United States amounts to *15 tons per day,* practically all of this being made into chewing gum which is placed on the market under a variety of names and in a variety of flavors.

A new method has been suggested for the extraction of this gum which may somewhat relieve the heavy tax on the rather limited (Mexican) forest supply; the young fruits are known to be filled with this gutta-percha-like latex and very probably some method may be found by which the half-grown fruits can be removed from the trees, boiled, and made to yield up their chicle content, thus leaving the tree unscarred by the deep tapping wounds which have heretofore been a serious feature of the case.

COPRA IMPORTS OF THE UNITED STATES.

There seems no doubt that copra imports into United States are increasing by leaps and bounds; for instance, in 1910 only about 13,000 tons were brought in while in 1911 there were over 23,000 tons handled, and in 1912 considerably over 31,000 tons; these figures do not include desiccated (or "shredded") coconut.

FRUIT-FLY DANGERS.

Probably all tropical countries are more or less infested with various species of fruit flies, Hawaii and Mexico being perhaps the most severely affected. A fixed quarantine against Mexican oranges is now being maintained on the Texas-Mexico frontier.

In 1899 and 1900 the writer made the first official inspection of the citrus districts of Mexico, finding the fruit even in the best orange districts very severely infested, in some cases 75 per cent of the fruit being attacked by the maggots of these fruit flies. In November, 1899, maggots were detected in Mexican oranges imported into San Francisco. Only recently, however, has the United States Government taken a firm stand toward preventing the introduction of this pest into the fruit-growing districts of the Southwest.

Doctor Sylvestri of the Italian Government has recently returned via America and Hawaii from a trip to West Africa after parasites of fruit flies. While a considerable number of various parasites of several species of fruit-infesting insects were discovered, it remains to be seen whether they will really check the infestation to any great extent. Various methods for trapping or controlling the adult fruit flies have been suggested; it appears quite feasible to trap a large percentage of the males in an infested grove by means of bright basins filled with kerosene. Strangely enough the famous Mally fruit-fly remedy of South Africa, which consists in spraying poisoned mixtures upon the leaves of infested trees, does not seem to have become popular, though it is probable that if properly applied this remedy would considerably reduce the pest, at least in districts where the natural host plants of the fly were absent.

The Philippines have a few species of fruit fly, but fortunately none of them seem to be doing any considerable damage thus far, and at least one of them is parasitized.

ARGENTINE COMMERCE.

Argentina has produced during the fiscal year of 1912 some 342,000 tons of beef besides about 70,000 tons of fresh mutton. The value of the beef and mutton exported amounted to about 80 million pesos. The total value of all animal products amounted in 1912 to not less than 376 million pesos, while that of the crop exports was over 560 million pesos in value, according to the Bulletin of the Pan-American Union.

VENEZUELAN BEEF.

On every hand there is evidence of agricultural progress from one end to the other of the great South American continent. For instance, in Venezuela there has just been established a gigantic stock-raising concern near La Guayra with a capital of ₱386,000; in the far interior at Barrancas on the Orinoco

River an establishment, equipped to handle some 25,000 head of cattle per year, has just been installed; this plant will make extracts, gelatine, and fertilizer, as well as salted meat.

Considering the excellent means of transportation that this plant will have and the exceedingly low price of cattle in that part of the world, success should be assured. A few years ago cattle were so cheap in the hinterland of Venezuela that they were shot merely for the sake of the skins, the meat being considered hardly worth saving.

ANOTHER TROPICAL AGRICULTURE JOURNAL.

The Fiji Planters' Journal bids fair to become one of the most interesting and valuable of the recent tropical agriculture publications; we are just in receipt of the second number of this journal which contains some 74 pages of interesting data on the various tropical crops of the Fiji Archipelago, together with market reports and crop statistics.

In an interesting article on coconut growing by H. H. Thiele, esq., we regret to note that bud rot occurs at present in Fiji.

It appears that Fiji is troubled with a peculiar coconut insect pest not known in other countries—a comparatively large Phasmid, or stick insect, which feeds upon the leaflets; there are two species of this pest, the larger one (*Phibalocera pythonius*) reaches a length of 20 or more centimeters and is wingless, while the other, of about half that size, is said to be a common and sometimes very severe pest in the "South Sea Islands." On the other hand, Fiji seems to be tolerably free from the terrible "uang," or rhinoceros beetle, of the Philippines.

A CUBAN COMMERCIAL EXPOSITION.

It is reported that the chamber of commerce of Santiago de Cuba intends to hold a national exposition to celebrate the official opening of the Panama Canal in the beginning of the year 1915.

NOTES BY P. J. WESTER, **Horticulturist.**

FARM PREMIERING IN SWEDEN.

The high standard of agriculture and husbandry and everything pertaining thereto in the two Scandinavian countries of Sweden and Denmark is a matter of common knowledge among those well informed, but owing to the linguistic isolation of these countries from the rest of the world many of the methods employed in the stimulation of this development are but little known.

The premiering of cattle, horses, and other domestic animals, and the competitive exhibitions of the manifold forms of handicraft as a stimulation to better productions are of commonplace occurrence in most countries, but it is not generally known that the Swedes have for several years extended this to the farms.

In those parts of the country where farm premiering is in practice the farmers who wish to compete forward their applications to the provincial authorities in charge of this work. An inspection jury is then selected which inspects the farms entered in the competition and awards the prizes.

In many parts of Sweden as in Germany it is a common practice to plant fruit trees along the roads which thus produce a valuable income and at the same time serve as shade trees.

We believe the Philippines would be a gainer by the emulation of the two practices above mentioned.

THE PROSPECTS OF THE AVOCADO IN THE PHILIPPINES.

It is a rather remarkable fact that the introduction by the Spaniards into the Philippines of the avocado, one of the most esteemed fruits of the American Tropics, was a failure, and it has remained for us to reintroduce this valuable fruit. As a matter of fact, avocado introduction seems to have been one of the first things that claimed the attention of the Bureau during its early days, and while those first introduced have been coming into bearing several importations of seed as well as bud wood have been made during the last two years culminating in the recent importation of 3,000 seeds from Hawaii.

Several of the avocados planted at the Lamao experiment station several years ago by the then horticulturist of the Bureau, Mr. W. S. Lyon, fruited this year. The flowers "set" very satisfactorily, but when the fruit was about or a trifle more than half-grown (in the height of the rainy season) practically all the fruit split and dropped. This was unquestionably due to the excessive sap pressure, while the fact that two seedlings were not so affected shows that individuality plays a more or less important part also.

The trouble mentioned has been noted for some years in Manila also, where the seasons are similar to those at Lamao, and it would seem that the prospective commercial avocado districts of the future should be located where the dry season coincides with the flowering and the ripening periods of the avocado, which in the Philippines seem to extend from February to the beginning of September. It is very probable that the highlands of Mindanao, with their evenly distributed rainfall and cool atmosphere, would produce a very superior avocado. In those sections where the rain falls principally from February to September avocado culture cannot be advised on any considerable scale and only those kinds should be planted there that have conclusively proved themselves immune to excessive precipitation during those months.

A "NEW" WEED KILLER.

This is, of course, comparatively speaking. It is safe to say that the "weed killer" referred to is unknown to Philippine agriculturists, though it seems to be a standard remedy now in some parts of the world. We refer, of course, to the destruction of weeds by chemicals, arsenite of soda in particular.

Fungicides and insecticides were the first sprays devised to combat plant pests and it was in the course of their application that the different effects of various chemicals upon different species of plants were first noted and followed by experimental spraying of plants with the object of utilizing the spray mixture as a, shall we say, "weedicide."

Among other chemicals, carbolic acid, benzine, kerosene, salt, sulphuric acid, copper sulphate, and arsenate of soda have been experimented with, but it seems that arsenite of soda has carried off the honors as a weed destroyer.

According to Wilcox in Press Bulletin No. 30, Hawaii Agricultural Experiment Station, arsenite of soda is used to a considerable extent in Hawaii as a weed destroyer.

We quote the following from the bulletin referred to:

> *Arsenite of soda.*—This chemical is usually prepared by boiling together common white arsenic and washing soda or sal soda. Theoretically, these chemicals combine in such a proportion that if about 1½ pounds of soda be used for each pound of arsenic, the proper combination will take place to render all of the arsenic soluble by the formation of arsenic of soda. In practice a considerably larger proportion of soda has been used, up to 4 pounds per pound of white arsenic. In preparing arsenite of soda we have had good results from boiling a mixture of 1 pound of white arsenic and 2 pounds sal soda per gallon of water for from fifteen to twenty minutes. The exact length of time to continue the boiling cannot be stated beforehand with any certainty but the boiling should be continued until the solution becomes clear. The clearing of the solution indicates that the proper chemical combination has taken place. * * * The stock solution obtained by boiling together white arsenic and sal soda is to be diluted before spraying with 15 to 24 parts of water, depending on the hardiness of the weeds to be destroyed.

In Australia, where, according to Wilcox, arsenite of soda has been widely used in weed destruction, the arsenite of soda already prepared is bought in the market and dissolved in water. It has there been used (in the destruction of the prickly pear) at the rate of 1 pound of arsenite of soda to from 5 to 9 gallons of water. For shrubby weeds a somewhat more concentrated solution has been used. According to Wilcox, arsenate of soda may be substituted for arsenite of soda.

In Hawaii some 500 acres have recently been treated with arsenite of soda by various rubber companies operating in that Archipelago and with very satisfactory results. The total cost per application, including material and labor, is ₱2.50 to ₱4.50 per acre. This destroys all except the most hardy weeds, which require one and sometimes two applications before they are entirely killed. About 100 gallons of the mixture is required to spray 1 acre.

As in the spraying of fungicides or insecticides, the mixture should be applied to the plant in a fine mist and not in such quantities that the solution runs down the plant into the ground, for, if excessive applications are repeatedly made, the accumulated arsenic in the land is poisonous to the cultivated plants. However, there is less danger from this source in the Tropics where the rainfall is abundant than in those countries where the annual precipitation is small.

NEW POSSIBILITIES IN DATE CULTURE.

It is well known that the date thrives in dry as well as humid climates within the Tropics and subtropics, though many people still labor under the delusion that the date can succeed under desert conditions only, owing to the fact that because of the large sugar content the ripening fruit ferments at low altitudes. This is due to the excessive humidity in those regions and date culture on a commercial scale has therefore been confined to arid regions where the fruit "cures" without difficulty.

It is now nearly fifteen years since the United States Department of Agriculture first undertook to import date suckers from the date-growing regions of the Old World and this met with sufficient success to encourage the dispatch of a second expedition for the same purpose, and this was again followed by others in order to obtain more material as well as to study the culture of the plant with a view of making part of the southwest of the United States a date-growing region. This enterprise, one of the most notable of the many plant introductions made by the

Department, has met with such success that a California concern last year sent two men to secure a large quantity of date plants from Arabia and Africa. They returned to the United States a short time ago with a consignment of no less than 9,000 plants.

As the imported varieties came into fruiting in the United States, the natural ripening of the fruit was not found satisfactory and experiments were therefore started to ascertain whether or not the fruit could be ripened artificially. The problem has now been solved, the immature fruit being cured in ovens with a raised temperature.

Thus, when humidity is no longer a barrier, it would seem that we may in the future see date culture extended to many regions of the earth where heretofore its culture, commercially speaking, has been an impossibility. Some 75 date seedlings are being planted at the Lamao experiment station.

PERIODICALS RECEIVED IN THE BUREAU OF AGRICULTURE LIBRARY.

Agricultor, Merida, Yucatan.
Agricultor Practico, Guantanamo, Cuba.
Agricultural Blaster, Wilmington.
Agricultural Bulletin of the Federated Malay States.
Agricultural Gazette of New South Wales, Australia.
Agricultural Gazette of Tasmania, Australia.
Agricultural Journal of India, Calcutta.
Agricultural Journal of the Mozambique Company, Portuguese East Africa.
Agricultural Journal of the Union of South Africa, Pretoria.
Agricultural News, Barbados.
(L') Agronomie Tropicale, Uccle, Belgium.
American Breeders Magazine, Washington.
American Florist, Chicago.
American Forestry, Washington.
American Journal of Public Health, New York.
American Journal of Veterinary Medicine, Chicago.
American Poultry Advocate, New York.
American Poultry Journal, Chicago.
American Sugar Industry and Beet Sugar Gazette, Chicago.
American Thresherman, Madison.
American Veterinary Review, New York.
Anglo Japanese Trade Journal, London. (Japanese edition of British Trade Journal.)
Angora Goat Breeders Journal, Portland.
Annals of the Entomological Society of America, Columbus.
Archiv für Wissenschaftliche und Praktische Tierheilkunde, Berlin.
Australian Meat Trades' Journal, Sydney.
Australian Meat Trades' Journal and Chilling Depots, Sydney.
Berliner Tierarztliche Wochenschrift, Berlin.
Boletin de la Asociación de Labradores, Zaragoza, Spain.
Boletin de la Biblioteca Municipal de Guayaquil, Equador.
Boletin de Bosques, Pesca y Caza, Santiago, Chile.
Boletin de la Camara de Comercio Filipina, Manila.
Boletim do Departamento Estadual do Trabalho, São Paulo.
Boletin de la Dirección General de Agricultura, Mexico.
Boletin de Fomento, San José, Costa Rica.
Boletin del Ministerio de Agricultura, Buenos Aires.
Boletin Oficial de la Secretaria de Agricultura, Havana.
Bollettino Tecnico della Coltivazione dei Tabacchi, Scafate, Italy.
Botanical Magazine, Tokyo.
Breeders' Gazette, Chicago.

British Trade Journal, London.
Bulletin Agricole, Port Louis, Mauritius.
Bulletin Agricole du Congo Belge, Bruxelles.
Bulletin of Agricultural Statistics, Rome.
Bulletin de L'Association des Planteurs de Caoutchouc, Anvers.
Bulletin Bibliographique Hebdomadaire, Rome.
Bulletin of the Bureau of Agricultural Intelligence and Plants Diseases, Rome.
Bulletin de la Chambre de Commerce de Saigon.
Bulletin de la Chambre d'Agriculture du Tonkin, India.
Bulletin Economique de l'Indochine, Hanoi-Haiphong.
Bulletin du Jardin Botanique de Buitenzorg, Java.
Bulletin of the Department of Agriculture, Jamaica.
Bulletin of Entomological Research, London.
Bulletin of the New York Botanical Garden.
Bulletin of the Pan-American Union, Washington.
Bulletin of the Philippine Library, Manila.
Bulletin de la Societé Royale de Botanique de Belgique, Bruxelles.
Business America, New York.
California Cultivator, San Francisco.
Canadian Entomologist, Guelph, Ontario.
Centralblatt fur Allegemeine Pathologie und Pathologische Anatomie, Jena.
Centralblatt fur Bakteriologie, Originale, Jena.
Centralblatt fur Bakteriologie, Referate, Jena.
Chacaras e Quintaes, São Paulo.
City of Denver.
Climatological Service of the Weather Bureau. Colorado section.
Colorado Dairyman, Fort Collins.
Comercio, New York.
Commercial America, Philadelphia.
Comtes Rendus, Paris.
Cordage Trade Journal, New York.
Country Gentleman, Philadelphia.
Criador Paulista, São Paulo.
Crop Reporter, Washington.
Cuba Magazine, Havana.
Cuba Review, New York.
Cuban American, Gloria.
(El) Cultivador Moderno, Barcelona.
Cultura Filipina, Manila.
Daily Consular and Trade Reports, Washington.
Deutsche Tierarztliche Wochenschrift, Hannover.
Dial, Chicago.
Du Pont Magazine, Wilmington.
Entomological News, Philadelphia.
(L') Expansion Colonial Bulletin de L'Institute Colonial Marseillais.
Exporters and Importers Journal, New York.
Far East, Tokyo.
Far Eastern Review, Shanghai.
Farm Journal, Philadelphia.
Farm Life and Agricultural Epitomist, Spencer.

Farmer's Guide, Huntington.
(O) Fazendeiro, São Paulo.
Feather, Washington.
Federal Reporter, New York.
Fiji Planters' Journal, Suva.
Filipino People, Washington.
Florida Grower, Tampa.
Formosan Agricultural Review, Taihoku (in Japanese).
Gardeners' Chronicle, London.
Geographical Journal, London.
Giornale di Risicoltura, Vercelli.
Gleanings in Bee Culture, Medina.
Hacendado Mexicano.
Hacienda, Buffalo.
Hawaii Educational Review, Honolulu.
Hawaiian Forester and Agriculturist, Honolulu.
Hoard's Dairyman, Fort Atkinson.
Horse Review, Chicago.
Hygienische Rundschau, Berlin.
India, Department of Agriculture, Memoirs, Bacteriological Service, Pusa.
India, Department of Agriculture, Memoirs, Botanical Service, Pusa.
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India, Department of Agriculture, Memoirs, Entomological Service, Pusa.
India, Department of Agriculture, Memoirs, Veterinary Service, Pusa.
India Rubber World, New York.
Indian Textile Journal, Bombay.
(L') Institut Pasteur, Annales, Paris.
(L') Institut Pasteur, Bulletin, Paris.
International Confectioner, New York.
International Sugar Journal, Manchester.
Japan Magazine, Tokyo.
Japan Weekly Mail, Tokyo.
Journal d'Agriculture Tropicale, Paris.
Journal de Medecine Veterinaire, Lyon.
Journal de Physiologie et de Pathologie Generale, Paris.
Journal of Agriculture, Wellington, New Zealand.
Journal of Agriculture, St. Louis.
Journal of Agriculture and Horticulture, Montreal.
Journal of the American Medical Association, Chicago.
Journal of the Board of Agriculture of British Guiana, Georgetown.
Journal of the College of Agriculture, Imperial University of Tokyo, Japan.
Journal of Comparatively Pathology and Therapeutics, Edinburg.
Journal of the Department of Agriculture of Victoria, Australia.
Journal of Economic Entomology, Melrose Highlands.
Journal of Experimental Medicine, Appleton.
Journal of Hygiene, Cambridge, England.
Journal of the Jamaica Agricultural Society, Kingston.
Journal of the London School of Tropical Medicine.
Journal of the New Zealand Department of Agriculture, Wellington.

Journal of the Royal Army Medical Corps, London.
Journal of Tropical Medicine and Hygiene, London.
Kabite, Manila.
Kansas Farmer, Topeka.
Korte Berichten voor Landbouw, Nijverheid en Handel, Java.
Lancet, London.
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Literary Digest, New York.
Long Island Agronomist, New York.
Louisiana Planter and Sugar Manufacturer, New Orleans.
Malay Mail.
Manila Times (Weekly).
Mededeeling Proefstation voor Vorstenlandsche Tabak, Batavia.
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Merchants' Association Review, Manila.
Mining Science, Denver.
Modern Sugar Planter, New Orleans.
Monthly Bulletin of Economic and Social Intelligence, Rome.
Monthly Bulletin, State Commission of Horticulture, San Francisco.
Monthly Summary of Commerce and Finance of the United States.
Mulford's Veterinary Bulletin, Philadelphia.
National Geographical Magazine, Washington.
National Nurseryman, Rochester.
(Los) Negocios, Barcelona.
New Zealand Farmer, Auckland.
North Queensland Register, Townsville.
Oesterreichische Wochenschrift fur Thierheilkunde, Vienna.
Official Gazette, Manila.
Oklahoma Farm Journal.
Olympic Announcer, Manila.
Oregon Agriculturist, Portland.
Outdoor World and Recreation, New York.
Pacific Dairyman, Seattle.
Pacific Poultryman, Seattle.
Paper Trade Journal, New York.
Pastoral Review, Sydney.
Petaluma Weekly Poultry Journal, California.
(Der) Pflanzer; East Africa.
Philippine Agricultural Review, Manila.
Philippine Agriculturist and Forester, Los Baños.
Philippine Craftsman, Manila.
Philippine Craftsman Reprint Series, Manila.
Philippine Education, Manila.
Philippine Islands, Bureau of Health, Quarterly Report, Manila.
Philippine Islands, Bureau of Public Works, Quarterly Bulletin, Manila.
Philippine Free Press, Manila.
Philippine Journal of Science, A. Chemical and Geological, Manila.
Philippine Journal Science, B. Medical Sciences, Manila.

Philippine Journal of Science, C. Botany, Manila.
Philippine Journal of Science, D. Ethnology, Anthropology and General Biology, Manila.
Philippines Monthly, Manila.
Philippines Observer, Manila.
Porto Rico Progress, S. Juan.
Posselt's Textile Journal, Philadelphia.
Poultry, Peotone, Illinois.
Poultry Review, Elmira, N. Y.
Proceedings of the Agricultural Society of Trinidad and Tobago, West Indies.
Progressive Farmer, Raleigh.
Queensland Agricultural Journal, Brisbane.
Recueil de Medecine Vétérinaire, Paris.
Reliable Poultry Journal, Quincy.
Renacimiento Filipino, Manila.
Resumen de Agricultura, Barcelona.
Review of Tropical Agriculture, Mexico.
Revista de la Asociación Rural, Montivedeo.
Revista Azucarera, Havana.
Revista Economica, Manila.
Revista Filipina de Medicina y Farmacia, Manila.
Revista del Instituto Agricola Catalán de San Isidro, Spain.
Revista del Ministerio de Obras Publicas, Bogota.
Revista Nacional de Agricultura, Bogota.
Revista Nacional de Colombia, Bogota.
Revista Tecnica del Ministerio de Obras Publicas, Caracas.
Revue Agricole, Noumea.
Riqueza Agricola, Lima.
Rubber World, New York.
Rural California, Los Angeles.
Sarawak Gazette, Kuching, Borneo.
Sarawak Government Gazette, Kuching, Borneo.
Schweizer Archiv fur Tierheilkunde, Zurich.
Science, Lancaster.
Sociedade de Geographia de Lisbon-Boletim, Belgium.
South Indian Agriculture, Madras.
Tennessee Agriculture, Nashville.
Tierarztliches Rundschau, Friedenau, Germany.
Tijdschrift voor Nijverheid en Landbouw in Neder-Landsch-Indie, Batavia.
Tobacco Leaf, New York.
Tropical Agriculturist, Colombo.
Tropical Life, London.
Tropical Veterinary Bulletin, London.
Twentieth Century Farmer, Omaha.
United States Bureau of Census Bulletin.
United States Department of Agriculture, Monthly Bulletin of the Library.
United States Department of Agriculture, Weather Bureau, Monthly Summary.
United States Experiment Station Record.

United States Farmers' Bulletin.
Veroffentlichunger des Kaiferlichen Gefundheitsamts, Berlin.
(La) Vie Agricole et Rurale, Paris.
Virchows Archiv fur Pathologische Anatomie und Physiologie, Berlin.
Wallaces' Farmer, Des Moines.
Wealth of India, Madras.
Weather Bureau Bulletin, Manila.
Weekly Statistical Sugar Trade Journal, New York.
West India Committee Circular, London.
West Indian Bulletin, Barbados.
Western Tobacco Journal, Cincinnati.
Zeitschrift fur Infektionshrankheiten, Berlin.
Zeitschrift fur Tiermedizin, Jena.
Zeitschrift fur Veterinarekunde, Berlin.

TEMPERATURE AND RAINFALL FOR AGRICULTURAL DISTRICTS IN THE PHILIPPINES.

By the DIRECTOR OF THE WEATHER BUREAU.

August, 1913.

[Temperature and total rainfall for 24 hours beginning at 6 a. m. each day.]

Date.	Abacá (Manila hemp).				Sugar, Iloilo.		Rice, Tarlac.		Tobacco.			
	Albay.		Tacloban.						Aparri.		San Fernando.	
	Temperature.	Rainfall.	Temperature.	Rainfall.	Temperature.	Rainfall.	Temperature.	Rainfall.	Temperature.	Rainfall.	Temperature.	Rainfall.
	°C.	*mm.*	*°C.*	*mm.*	*°C.*	*mm.*	*°C.*	*mm.*	*°C.*	*mm.*	*°C.*	*mm.*
1	26.3	34	27.4	2.6	27.6	21.5	26.5	10.1	27.4	7.9	27.2	3.3
2	27	6.1	28	-------	27	26.7	26.8	-------	27	-------	27.9	.5
3	27.6	-------	28.3	-------	27.8	1	26.2	2.5	27.6	-------	28.4	5.3
4	26.6	3.3	28	3.8	28	17	25.7	20.4	27.6	-------	27.4	24.2
5	26.2	13.3	26.9	1.1	26.4	101.6	26.2	18.3	26.8	-------	27.6	5.1
6	25.6	15.5	27.7	-------	25.4	39.4	27.6	17.7	27.1	-------	28.9	6.9
7	26.8	1	28.4	.3	25.7	8.8	26.8	32	26.9	1.3	28.8	35.8
8	28	-------	27.7	-------	27.2	-------	25.4	27.9	27.9	-------	26.2	2
9	27.8	-------	28.1	27.4	26.5	-------	28.1	-------	28	-------	27.9	11.9
10	27.7	-------	28	-------	27.8	-------	28.2	11.2	28.2	2	27.2	54.3
11	27.2	-------	28	-------	27.4	-------	28.4	8.4	27	1.8	27.4	12.2
12	27.2	17.5	26.6	17	26.8	10.2	27.2	32.5	27	.8	27.4	5.3
13	26.7	31.6	25.2	11.8	26.9	-------	27.2	-------	27.9	-------	27.1	.8
14	25.3	5.4	26.3	6.1	26.4	-------	27.4	6.9	28	-------	27.4	39.6
15	26.8	2.1	28.3	-------	26.2	36.4	27.5	5.1	27.4	42.7	27.4	73.6
16	27.4	3.8	27.5	.3	26.5	.5	24	7.3	24.9	17.8	24.4	120.9
17	26.7	-------	26.8	.5	26.8	19.8	27.9	-------	27.4	-------	27.4	-------
18	28.3	.3	26.4	4.3	26.7	4.5	29	-------	27.7	8.1	28.4	-------
19	28	13.9	26.8	8.7	27.1	1	29.6	45.2	27	.5	29.2	1
20	26	1.3	26.8	3.8	26.6	2	27.4	22.9	26.9	7.9	27.8	17
21	27.1	1.5	25.8	.5	26.5	6.1	27.5	9.7	27.2	-------	27.3	1
22	26.7	1.1	26.6	1.3	26.4	25.4	27	-------	27.9	-------	28.4	5.3
23	26.2	10.2	27.4	9.7	25.2	43.7	27.4	7.6	27.8	-------	28.2	3.3
24	26.8	22.9	26.4	1	25.2	9.3	27.8	8.1	27.9	-------	27.8	3.6
25	27.2	5.6	26.3	5.6	26.5	-------	26.2	38.9	28.1	-------	28.1	85.1
26	26.9	2.6	27.4	-------	26.8	20.6	26.6	12.9	27.8	-------	27.5	16.8
27	26.8	1.3	27.5	13.2	25.6	65	26.9	.8	28	-------	27.5	3.6
28	26.5	-------	26.5	-------	24.8	40.7	27	3	28.5	-------	28	4.1
29	26.9	-------	26.9	2.8	26.7	1	26.4	-------	29	-------	28.4	-------
30	27.1	.8	27.1	-------	26.4	1.5	27.2	4.8	28.6	-------	28.3	9.4
31	26.4	-------	24.8	36.8	25.9	2.3	28.4	3.8	27.6	6.9	27.6	-------

ORGANIZATION LIST, BUREAU OF AGRICULTURE.

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Assistant to the Director, H. T. EDWARDS.

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Entomologist, C. R. JONES.
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Assistant Entomologist, D. B. MACKIE.

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Trinidad	Benguet	A. L. BRADLEY, Acting Superintendent.

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Lamao	Bataan	P. J. WESTER, Horticulturist in charge.
Singalong	Manila	H. R. REED, Acting Superintendent.

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Cebu	Cebu	E. F. SOUTHWICK, Acting Superintendent.
Virac	Albay	E. H. KOERT, Superintendent.
Batangas	Batangas	H. T. NIELSEN, Forage Expert, Superintendent.
Ilagan	Isabela	O. S. SORIANO, In Charge.
Trinidad Garden	Mountain	AUSTIN M. BURTON, Superintendent.
Santa Cruz	Laguna	P. BRAUN, Superintendent.

FORAGE FACTORY.

Pandacan	Manila	W. F. RODGERS, Superintendent. D. F. COYNER.

VETERINARY RESEARCH LABORATORY.

Dr. WILLIAM H. BOYNTON, Pathologist.
Dr. C. H. SCHULTZ.
MAURICE B. MITZMAIN, Veterinary Entomologist.

QUARANTINE STATIONS AND MEAT INSPECTION.

Dr. F. W. WOOD, Supervising Veterinarian in charge.

Pandacan Quarantine Station	Vacant.
Manila Matadero	R. W. NEWCOMB, Veterinarian.
Sisiman Matadero	H. H. LADSON, Veterinarian, Superintendent.

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Stanton Youngberg.
Charles H. Leavitt.

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John R. Burns.
W. A. Curtis.[1]
W. L. Davis.
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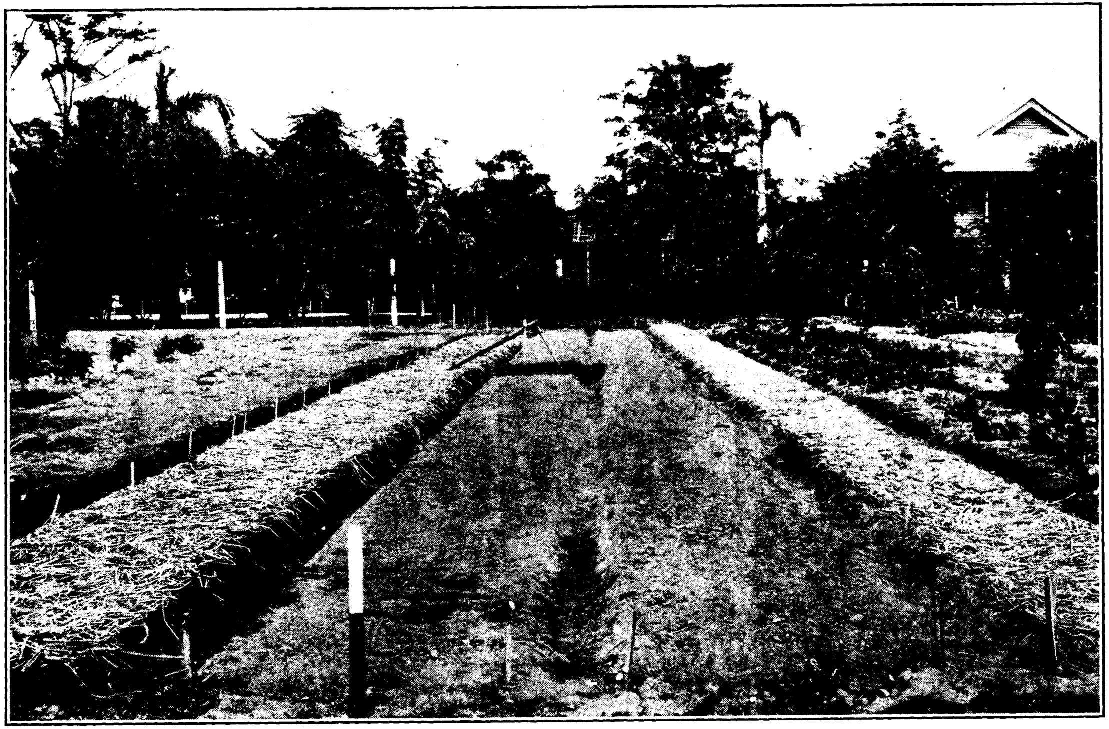
[1] On leave.



Comparative-test vegetable plats at the Singalong experiment station. Presumably acclimatizable vegetable varieties are tried out here before being distributed.

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ANNUAL REPORT OF THE BUREAU OF AGRICULTURE.

GENERAL AGRICULTURAL CONDITIONS.

The rice crop of the past year, including the main crop harvested in December, 1912, and the short-season crop which has just been harvested, was the heaviest recorded in many years. It is estimated that the rice crop of the fiscal year 1913 was fully 100 per cent greater than the crop of the previous year. The high prices received for the rice crop of the fiscal year 1912 resulted in the planting of a largely increased area, and favorable climatic conditions prevailed throughout the rice-growing season. As a direct result of this bumper crop, there was a decrease of more than 80 million kilos, or about 5 million pesos in value, in rice imports, and conditions throughout the principal rice-growing provinces have been good. The distribution by the Bureau of Agriculture of selected and tested seed, of varieties of rice that have produced an average yield of 2,000 kilos or more per hectare, has served to stimulate an interest on the part of the planters in the use of good seed of this important crop.

A reflex of the short rice crop of the previous year has been noticed in the large maize crop of this past season. The campaign to popularize maize called the attention of the people to its value, and many turned to it as a substitute food supply during the shortage of rice. Many farmers are now growing maize as a regular crop in addition to rice. It is important that further action be taken to develop the use of maize as a human food, in order that the farmers may be able to dispose of their increased crops.

The grinding of the sugar crop was finished rather late this year, as the growth of the cane was retarded by the dry weather during the early part of the season. The quality of sugar produced by the small mills classified rather low which was somewhat disappointing to the planters. Continued low prices have also been discouraging, but the present condition of the sugar crop is good and a better feeling now prevails. Several new centrals have been erected or contracted for during the year. Sugar exports for the fiscal year 1913 showed an increase of approximately 30 million kilos, but a decrease of nearly 2 million pesos in value, over the previous year.

The copra crop suffered very severely from the phenomenal drought of the previous year and the typhoons of this year. The Visayas and Mindanao have not been quite so badly affected, but the output of certain districts in Laguna and Tayabas in Luzon have been reduced by about one-half in some cases. The falling off in bulk of the exported product, 113,000 tons against 169,000 tons in 1912, has been about 33 per cent. The good prices have helped somewhat to offset this reduction in quantity, the value of the exports for the past year being 23 million pesos, or about 28 per cent less than the previous year. On account of the high price of abacá, copra has not been able to maintain the ascendancy, gained once during the previous year, over the fiber crop which still ranks first among Philippine exports.

None of the coconut plantations have actually been lost, however, and the trees are now carrying almost the normal number of fruits. Considering the fact that it requires about twelve months between flower and mature fruit, the prospects for the coming year are good. Copra prices have held firm throughout the year. The new feature of artificially drying copra without direct contact of smoke with the "meat" is slowly but surely gaining ground; there are at least three private concerns turning out smokeless copra by means of dryers using either steam pipe, or flues, to furnish heat, and several others will probably install plants soon.

The tobacco crop of the past year was not particularly good, but the results of the 1912 drought have now practically disappeared. Throughout the year the traveling inspectors in the Cagayan Valley under control of the tobacco station at Ilagan have urged the multiple-crop system among the Filipino planters. This work is beginning to show good results and the system of tobacco or nothing is fortunately growing in disfavor. The production of leaf in Luzon is estimated at 30,500 tons as against 28,000 tons for the previous year. It is in the export cigar trade that the tobacco prosperity displays itself; this item has exceeded that of 1912 by over 60 per cent; 288 millions (worth ₱6,700,000) against 175 millions for the previous year—an unprecedented annual increase. The export of leaf and miscellaneous tobaccos is also rapidly increasing and has amounted to over 4 million pesos this year.

The policy of winnowing the tobacco seed gratis for small planters has gained in favor and 12 municipally owned machines are now in evidence in the Cagayan Valley. The Bureaus of Internal Revenue and Agriculture appear to have finally instilled into the minds of the planters the necessity for erecting proper curing sheds for the raw crop; this feature not only prevents losses but insures better quality in the cured bales.

During the year the exports of abacá (Manila hemp) amounted to 144,576 metric tons, or about 6 per cent less than the previous year, in quantity, and to ₱46,089,488, or 41.5 per cent more than the previous year, in value. The value of this year's exports of abacá, therefore, not only makes this crop the banner export crop for the year but also marks the highest point which it has reached in the history of the industry, the value of the exports of 1905, amounting to ₱44,292,482, being the highest point reached prior to this year. The quality of the abacá fiber as well as the cultural methods practiced throughout the provinces remain unchanged, or perhaps with a tendency to the worse. The effect of the drought and typhoons of 1912 on the production of abacá became evident during January and February, and it is estimated that the production during the fiscal year 1914 will range between 110 and 120 thousand metric tons.

The condition of the maguey industry remains practically unchanged. The production of fiber during the year, however, has considerably increased, both in quantity and in value, owing to the recent rise in the value of all hard fibers. The exports of maguey for the year were 8,336 metric tons, valued at ₱1,408,788, or an increase of 3,843 tons (or about 84 per cent in quantity) and ₱766,846 (or about 119 per cent in value) over the exports of last year. There has been a tendency on the part of the maguey producers to increase the areas cultivated and it is hoped that this will be supplemented by an attempt to introduce machinery to replace the present retting method for cleaning the fiber.

The kapok industry has also exhibited encouraging signs of improvement during the year, chief among which are the establishment of several medium-sized and large plantations in Central Luzon. These are being managed in an up-to-date manner and with the ultimate view of using machinery for cleaning and baling the floss.

BUREAU OF AGRICULTURE.

GENERAL STATEMENT.

The work of the Bureau of Agriculture covers four general lines of activity, viz, administration, public services, investigation, and dissemination of information. Definite progress has been made and substantial results have been obtained during the past year in each of these departments. With a rinderpest campaign that has required the expenditure of approximately two-thirds of the total appropriation, and with a general locust infestation throughout the Archipelago, the resources of the Bureau have been severely taxed. It has been possible, however, not only to carry on this defensive work against pests and diseases on a larger scale and with more activity than heretofore, but also to establish various important lines of constructive work, and to close the year with a considerable surplus to the credit of the Bureau's appropriation. Certain features of the work of the Bureau during the past year are deserving of special comment.

On July 1, 1912, the entire work of the Bureau of Agriculture was placed under a project system, the general features of which were outlined in the last annual report. This system of organization placed a definite responsibility on each employee, provided a definite allotment for each line of work, and insured a complete and accurate record of all work done. The operation of the project system has been highly satisfactory and its use has resulted in a marked improvement in both organization and administration.

Of what may be termed the public services of the Bureau of Agriculture, the most important is the campaign against rinderpest. The strict enforcement of quarantine regulations has prevented the introduction of disease from foreign countries. The measures used in eradicating rinderpest infection existent within the Archipelago have resulted in the cleaning up of all infected territory in the Visayas, northern Mindanao, and southern Luzon. The number of infected provinces has been reduced from 11 to 8, and of infected municipalities from 34 to 23. At the close of the year there was no known rinderpest infection in the Philippine Islands south of the city of Manila.

One of the most serious and difficult problems of the year's work has been the control of a locust infestation that has covered practically the entire Archipelago. Under the provisions of Act No. 2121 of the Philippine Legislature the disbursement of Insular funds appropriated for the extermination of locusts, and the organization and control of the locust campaign is delegated to the Bureau of Agriculture. During the past year it has been necessary to detail six employees on this work. A locust board has been appointed in each province, funds and supplies have been furnished the infested districts, regulations governing the methods of operation and detailed information regarding locust eradication have been widely disseminated, and in different districts employees of the Bureau have taken direct charge of the campaign. At the close of the year the infestation, though still widespread, is fairly well under control. The work is now well organized, and funds and supplies are available in all infested provinces.

The improvement of the live stock of the Islands by the production, sale, and loan of breeding animals has made satisfactory progress. A total of 288 animals have been born at the different farms of the Bureau. One hundred and ten animals have been sold, a large part of which will be used for breeding purposes. Twenty-seven stallions and five bulls are now being used by the Bureau for public live-stock breeding in the provinces. There is a larger demand for good stallions, bulls, and boars than the Bureau is able to supply from its own farms, and an order has been recently placed in the United States for 57 head of breeding stock.

The demand for selected seeds and plants continues to increase each year. During the past year the Bureau has mailed 12,000 collections, containing about 125,000 separate packages of seeds. More than 600 similar collections have been distributed from the Central Office, and large quantities of seed in bulk have been furnished provincial governors, supervising teachers, and farmers coöperating with the Bureau. Some 30,000 mulberry cuttings, 28,000 sisal bulbs, 1,000 pineapples suckers, and other miscellaneous plants have also been distributed. The seed and plant distribution work of the Bureau reaches practically every municipality in the Archipelago, and is an important factor in agricultural improvement.

Among the more important lines of investigational work should be mentioned that of the veterinary pathologist and entomologist. The completed work of these investigators is covered by fourteen papers published or completed for publication during the year, the titles of which are given in this report. The important rice investigations that have been carried on for five years with more than 1,000 local varieties of rice have now reached a point that makes possible the distribution of seed of selected and thoroughly tested varieties. Investigations with maize have developed the fact that two of the local varieties give better results under local conditions than any varieties yet imported. All of the principal varieties of abacá from the more important abacá-producing provinces have been collected and planted in experimental plats at the La Carlota station. As the future development of the abacá industry must be based on the determination of the best varieties, this work should be of great value. Similar work with both imported and local varieties of cotton is now being carried on at La Carlota.

At the Singalong experiment station more than 1,000 varieties of vegetables and forage plants have been tested during the year. At the Alabang farm 134 varieties of bananas have been permanently set in the trial plats. At the Lamao station important investigational work has been carried on with the anonas, citrus fruits, pineapples, avocados, mangos, papayas, and other fruits and vegetables.

In order that the information obtained by the Bureau in its investigational work may be utilized by the farmers in producing larger and better crops, it is essential that this information be widely disseminated. The publications issued during the year include thirteen numbers of the Philippine Agricultural Review (the last annual report of the Bureau was published as a special number of the Review), five bulletins, seven circulars, and three reprints.

The method of promoting agricultural development by taking information directly to the farmers, and demonstrating the value of improved methods on the farms, is now a prominent feature of the work of the Bureau. The coöperative demonstration work has been thoroughly organized during the past year, and definite results have already been obtained.

PERSONNEL.

The Director of Agriculture departed for the United States on April 20, 1913, for an official trip in connection with the affairs of this Bureau and those of the Panama-Pacific International Exposition, and has been absent from the Philippine Islands since that date. During this period of absence of the Director, Mr. H. T. Edwards, Assistant to the Director, has been in charge of the work of the Bureau as Acting Director. Mr. C. M. Conner was appointed chief, division of agronomy, effective July 1, 1912. Dr. Frank C. Gearhart resigned the position of chief, division of animal husbandry, on March 5, 1913. Mr. C. W. Edwards, animal husbandman, was designated acting chief of the division of animal husbandry on March 6, 1913, and served until May 1, 1913, when he was permanently appointed chief of the division. Mr. Benjamin P. Lukens was appointed chief, division of statistics, on January 1, 1913. Mr.

Lukens, up to that date, had been acting chief of that division. Mr. Zalmon K. Miller resigned the position of chief, division of machinery and construction, on January 4, 1913. This position has not been permanently filled since that date.

During the fiscal year 9 Americans have been appointed to classified positions and 11 have been separated by resignation and transfer, a net decrease of 2. Thirty Filipinos were appointed to classified positions and 6 were separated by resignation and transfer, a net increase of 24.

The number of Americans temporarily employed was slightly less than that for the preceding year, while the number of temporary Filipino employees was increased materially.

DIVISION OF ANIMAL HUSBANDRY.

PURCHASE AND SALE OF ANIMALS.

This project covers the purchase within the Islands of all animals for the various branches of the Insular Government and for the city of Manila, and the sale of animals belonging to the Bureau of Agriculture.

Forty-eight purchases, including 311 animals, and 59 sales, including 112 animals, were made during the year. The total amount paid for animals purchased was ₱21,509, of which ₱11,280 was for the Bureau of Agriculture and ₱10,229 was for other branches of the Government. The total sales of Bureau of Agriculture breeding stock amounted to ₱7,280, and ₱624.50 was received as a surcharge on the purchase of live stock for other branches of the Government. For complete data on this subject see Tables 12 and 13 (appendix).

On March 11, 1913, an order was placed for the following animals to be purchased in the United States:

Swine: 4 Duroc-Jersey sows, 4 Duroc-Jersey boars, 4 Yorkshire sows, 4 Yorkshire boars, 10 Berkshire sows, 10 Berkshire boars.
Stallions: 5 standard or thoroughbred stallions.
Goats: 5 billies under 18 months.
Cattle: 10 pure-bred Hereford heifers, 5 pure-bred Hereford bulls.

EXPERIMENTAL BREEDING.

The entire work of the production of breeding animals, where the process involves the introduction of foreign blood, may be considered of an experimental nature. As limited funds are available for this work the greater part of the data of this project must be obtained in connection with the work of production. However, there is one phase of purely experimental work the importance of which is considered sufficient to warrant its undertaking at this time, i. e., the determination to what extent the size and general conformation of the native horse can be improved without the introduction of foreign blood. With this end in view, 22 large native mares of good conformation were selected to be bred to "Carbonero" No. 44, a native stallion 54 inches in height and of superior conformation.

The experiment was begun March 3, 1911, at which time the following mares were assigned to this project: A–26, B–2, B–53, B–87, B–94, 33, 47, 68, 90, 96, 45, 99, 108, 112, 113, 114, 115, 178, 179, 180, 182, 254.

Out of the total number of mares assigned to this project, 14 dropped foals during the year, sired by "Carbonero;" of the remainder 3 were considered in foal at the end of the year, and 1, No. 114, was assigned to stallion "Hamayoon."

FEEDS AND FEEDING.

The object of this project is to ascertain the comparative values of different feeds and feeding combinations for different classes of live stock and poultry fed under various conditions; and to determine the adaptability and cost of production of feeds grown on various soils and under different conditions.

Feeding tests with papayas.—During the second quarter there was partially concluded at Alabang a hog-feeding test with papayas. The test was not fully completed, owing to the lack of papayas, the trees being destroyed by the wet season and typhoons. A more extensive test will be made during the coming year.

Two hundred and seventy-nine trees yielded a total weight of 1,251.05 kilos during the period between July and October. This probably was not more than half the weight they should have yielded in that period of time under ordinary conditions.

In the test the pens were divided as follows:

Pen I contained 3 young sows. They were fed a gradually increasing ration of Pandacan mixed feed No. 14.

Pen II contained 3 young sows. They were fed a ration of Pandacan mixed feed No. 14, and as much papaya as they would eat each day.

Pen III contained but 2 sows. These animals were fed a ration of Pandacan mixed feed No. 14, and as much papaya as they would eat each day.

Pen IV contained 2 sows. An attempt was made to feed only papayas to this pen. The Pandacan mixed feed was gradually reduced and the ration of papayas increased until at the end of two weeks papaya alone was being fed. The pigs, however, showed a disinclination to eat the straight papaya ration, so a small quantity of the mixed feed, amounting to 0.3 kilo per day per head, was added to the ration.

In comparing the data obtained in this test it was noted that the total individual increase and, in nearly every case, the daily gain per animal were materially increased by substituting papaya for a portion of the grain ration, while the results obtained with Lots III and IV would seem to indicate that a practically entire ration of papaya will not give nearly as satisfactory gains as when the papaya is combined with even a small amount of grain.

Although this test was not of sufficient duration to consider the results as conclusive, they indicate very strongly that papayas when combined with other components form a valuable swine feed.

Kapok-seed meal feeding test.—During the first half of the present fiscal year a feeding test with kapok-seed meal was carried out at Alabang, the purpose of which was to determine the value of this meal as a ration for cattle. First, only a preliminary test was undertaken with 3 steers, and no evil effects being discovered, a larger test was undertaken with 12 bullocks, Nos. 39, 54, 684, 701, 853, and 2473 in one division and Nos. 24, 706, 719, 735, 843 and 1977 in the other. The first lot were fed the usual ration and the second lot started on a ration of 2½ kilos of oats and one-half kilo of kapok-seed meal, with 30 kilos of green forage in addition to the pasturage.

The results of this test tend to show that kapok-seed meal may form a valuable adjunct feed for cattle, although it is a fat rather than a muscle-producing feed and could perhaps be used more advantageously in finishing cattle for market than for the feeding of work cattle.

When fed to swine it was found that the meal had a poisonous effect.

Forage crops.—At Trinidad, oats proved to be the most satisfactory green forage crop grown during the year, one crop sown in December giving three very heavy cuttings during a period of about eight and one-half months. The experience at this station the past season indicates very strongly that oats may serve as a very good green forage crop for some of the northern provinces. The sorghum sown at this station did very poorly.

Among the improved pasture grasses experimented with the paspalum (*Paspalum dilatatum*) has proven by far the most satisfactory. Two fields of approximately 1.5 hectares each planted some two years ago are now in the permanent pasture stage, being entirely covered with a heavy closed sod, which adds very materially to the stock-carrying capacity of the station. At this station this grass appears to withstand the rigors of dry and wet seasons alike. A considerable portion of the lowland native-grass pastures have been planted (by settings) to paspalum. This appears to be a successful method of pasture improvement as the settings stool properly crowding out the less desirable native grasses. During the coming rainy season an attempt will be made to improve a portion of the upland or clay hill pastures in this manner.

At the Bicol farm, Virac, Catanduanes, a sufficient amount of green forage has been raised to meet the demands of the station and to supply the public with a large amount of seed. Japanese millet has been successfully grown at this place, and it is reported that the people have become very much interested in the crop.

At the Batangas breeding station, of the 6 hectares under cultivation about one-half is devoted to the growing of Rhodes grass, Guinea grass, corn, and such legumes as guar and canavalia. These are reported as having given very satisfactory growths.

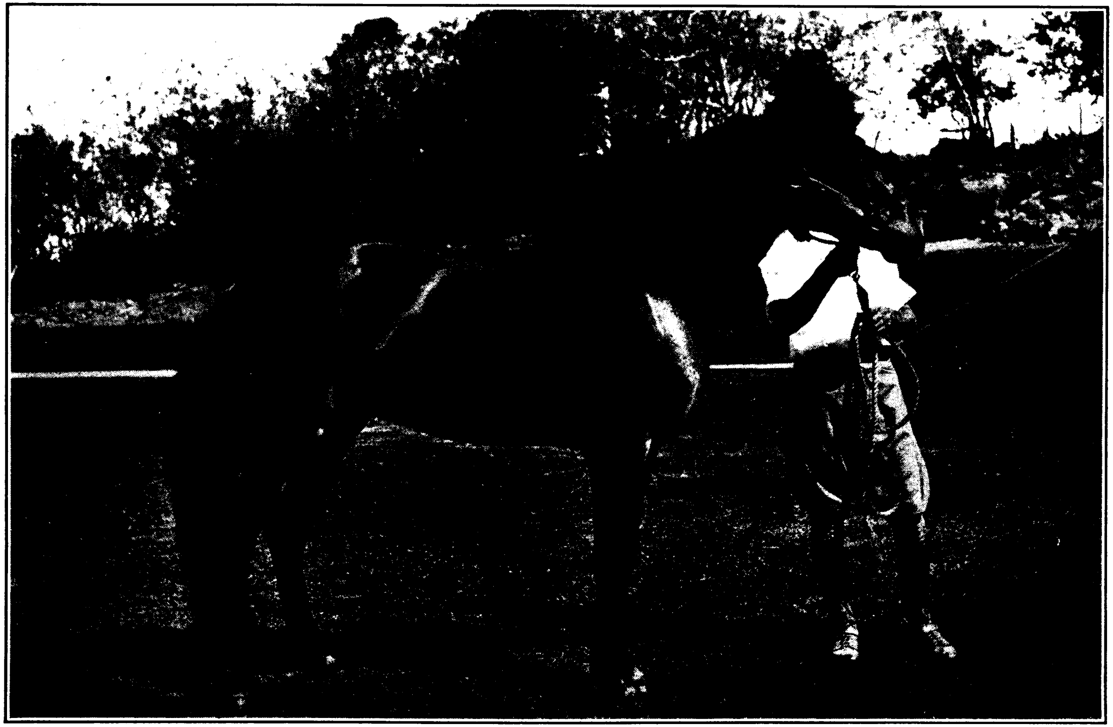
ALABANG STOCK FARM.

Forage crops.—At the Alabang stock farm, Guinea grass continues to be the main green forage crop. It is interesting to note that a field of this grass planted in July, 1910, is still producing heavily. Contrary to the common consensus of opinion, this grass has proved at this station to be a very fair pasture grass. The above-mentioned field was pastured very closely during the last two dry seasons with apparently no ill effects to the crop produced the following wet seasons. The principal objection to this forage as a pasture grass is its nonstooling character.

An experiment was carried on at this station to determine the best methods of planting Guinea grass. Two plots 2 meters wide and 300 meters long were selected, one being planted after the manner of palay seeding, the other in ordinary rows. The later gave by far the heavier yield. However, the portion of the field closely planted made a sufficient growth to indicate that this method could be safely used in planting for pasture.

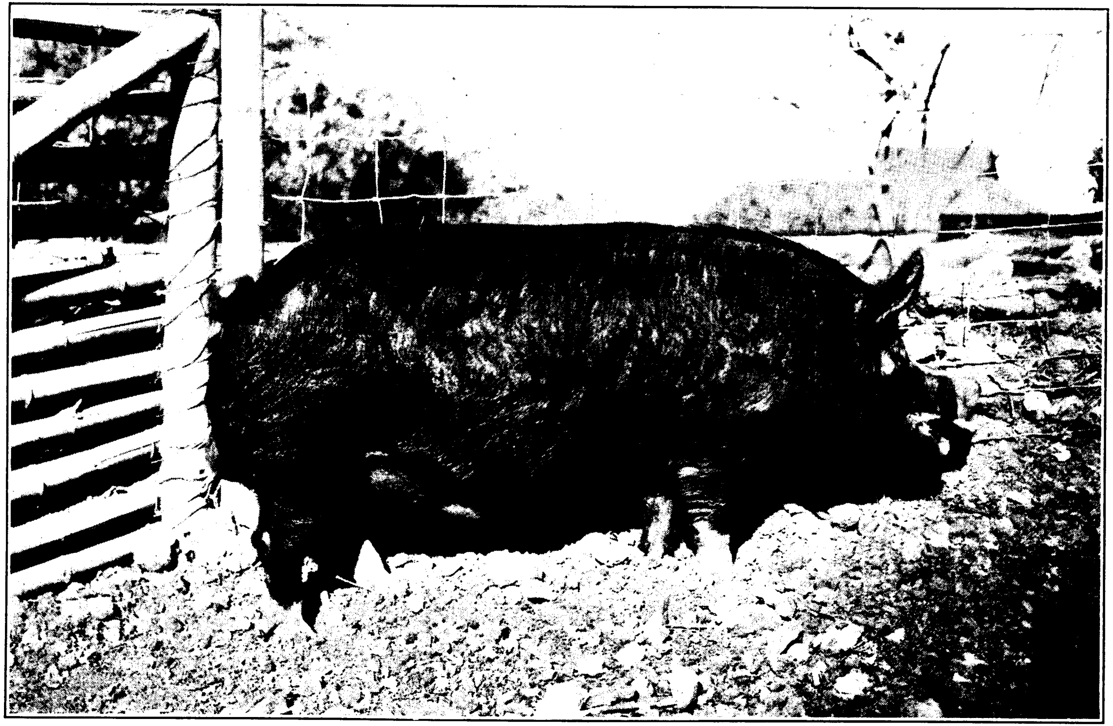
Considerable sorghum was grown during the past year. The method of broadcasting proved quite successful during the wet

PLATE II.



Good type of grade or "mestizo" stallion, Alabang stock farm.

PLATE III.



Pure-bred Berkshire boar, type used in pure-bred and public-breeding work.

season; however, this method is not advocated for the dry season as cultivation is necessary at that time.

About 3 hectares of paspalum was planted out and it promises to become of great value as an improved pasture grass at this place. It was found, however, that the grass, although being very drought resistant, failed to make an appreciable growth during the dry season without irrigation. The grass proved palatable to all classes of stock.

Sudan grass (*Andropogon halepensis*), of which a small plot was grown, is a very slender-stemmed sorghum which promises to be a very valuable green fodder for horses. The yield is apparently about 12 tons per hectare, producing three cuttings per season.

The Rhodes grass (*Chloris gayana*) continues a successful hay grass. Three cuttings of the grass have been made during the past year and there is a sufficient supply of baled hay on hand for the needs of the station for at least one year. No hay has been purchased at this station since December, 1911.

Para (*Panicum barbinode*), although not as palatable to the stock or as heavy a producer as Guinea grass, proved very well adapted to low swampy areas where other improved grasses failed to grow.

Japanese sugar cane, a very slender-stemmed quick-growing cane with an immense amount of foliage, when grown in conjunction with stizolobium bean produced an immense tonnage of very fair green roughage. The cane was planted about the middle of February, 1913, and at the time of cutting averaged 1.6 meters in height. A point in favor of the stizolobium bean is the fact that weevils do not destroy the seed when harvested.

Silo.—The silo completed the early part of the past fiscal year has proved a very successful venture. This silo is built entirely of reënforced concrete, being 20 feet (6.20 meters) in height and 16 feet (5.07 meters) in diameter, with a capacity of approximately 110 tons.

The first two-thirds of this silo was filled with a mixture of sorghum and sugar cane, and the last third with sorghum mixed with cogon and aguiñgay grasses in the proportion of about two-thirds sorghum to one-third grass. The silage produced was of first quality, the animals eating it with relish. Formerly there was a shortage of feed supply at this station for work animals during the months of November, December, and January; the silo, however, has been found to entirely meet the needs at that season of the year.

TRINIDAD STOCK FARM.

The conditions at this farm have remained very satisfactory throughout the year. The cattle have been kept in the best of condition on the station pasturage, no grain being fed to any of the herd excepting the two pure-bred bulls.

The principal improvement consisted of the repair of about 3 kilometers of fence. No permanent improvements in the way of building were attempted.

The station superintendent has a very good general knowledge of veterinary practice and has frequently been called upon to attend to the ailments of animals of the vicinity. Seventeen native stallions and one bull were castrated during the year. The total amount of money received for subsistence of private animals was ₱557.21. Of this sum ₱309.16 was collected for pasturage alone.

The laborers used at this station during the period were for the most part Igorots, as these people have proved better adapted for handling live stock and for general work than other classes of labor available at this place.

PUBLIC BREEDING PROJECT.

The object of this project is the upgrading of the native live stock by offering free to the public the services of improved sires.

The system or plan of work pursued is the maintenance of stud animals for public use at (1) permanent provincial central stations, (2) temporary provincial stations, and (3) at the regular farm stations. Aside from these methods a few animals are loaned on memorandum receipt to various branches of the Government.

In connection with this public breeding work (aside from that carried on at the Bureau farms), the promiscuous loaning of sires was formerly extensively practiced. The results were so unsatisfactory that the plan is now followed in but few instances. It has been found that in order to obtain satisfactory results facilities for the proper care and handling of the animals must be provided and the work placed in charge of a competent superintendent. The results of the past few years show that the most satisfactory means yet adopted of supplying these requisites is through the central stations.

During the fiscal year 1912 the first two central stations were established at Virac and Bagamanoc, Catanduanes, and in October of the present year the Batangas station was completed.

At the two former stations the entire expense of maintenance is defrayed by the provincial government, while at Batangas the Bureau provides for the care and maintenance of the animals, the farm labor being supplied by the province.

The results accomplished at these stations have exceeded expectations, and the people are showing a keen interest in the work that is being carried on.

At Batangas and Virac the stations also provide a center for the conducting of the agricultural demonstration work.

Catanduanes.—The work of the year in the Island of Catanduanes has been productive of very good results. The stallions located at this place are credited with a total of 263 first and 169 return services, and 160 foals, by these sires, have been dropped during the year.

The Nellore bull No. 412 is allowed to run at large with the herds that pasture in the vicinity of Virac. It is difficult to keep an exact record of results in this connection, although 14 calves have been identified as his get during the season. These crosses are spoken of by Mr. Koert as being distinctly of the Indian type.

An effort is being made in this island to impress the people with the importance of castrating inferior male animals, and during the year the superintendent has performed 125 emasculations.

In connection with the swine breeding at this station the practice of having the sows brought to the boar for service did not prove satisfactory, owing principally to the fact that the owners were ignorant as to the proper time to present the animals. The system followed at present of allowing the boar to run at large in the various near-by barrios has been conducive of much better results.

The Arabian stallion "Pharaoh" died on March 16. On February 16 the station at Bagamanoc was removed to the former municipality of Payo, which place is more centrally located and has better facilities for the growing of forage and pasturage.

A trail from Virac to Viga is in the process of construction, upon completion of which it is recommended that a large stallion be sent to this station.

Batangas.—The fact that the three stallions, although located at the Batangas station since November 5 only, have had a total of 355 services is the most convincing evidence of the interest that the people of the province are taking in this work. In spite of this heavy service the stallions have been maintained in the pink of condition, due to the efforts of the foreman who is directly in charge of stud animals at this station.

Temporary stations.—At the beginning of the year the stallions Hassan, Sakarra, and Highball were located at temporary stations in the Ilocos Provinces, in charge of a Bureau foreman. It became necessary on September 7, 1912, to transfer this foreman to Manila, at which time the stallions were loaned on memorandum receipt to the province, and placed in direct charge of native caretakers.

During the period that the foreman had charge of the work, very successful results were obtained, but soon after his transfer the number of services decreased rapidly and the stallion Sakarra was transferred to Manila on February 4, 1913.

Oriental Negros.—Since the beginning of the year the Arabian stallion Vedas, native stallion No. 185, and Indian bull No. 420 have rendered good service in the island of Siquijor, as has also the Arabian stallion Noureddin, located at Dumaguete since December 8, 1912.

The central-station plan, as previously stated, has proven by far the most efficient of all methods attempted in connection with the public breeding work. Although there are as yet but two of these stations, it is considered that the results achieved in the short time since their establishment are equal to those accomplished during the entire previous period from the miscellaneous loaning of stud animals.

HORSE PROJECT.

The object of this project is the production of superior horses for disposal to the public for breeding purposes, and for use of the Bureau in conducting the various lines of breeding work.

Alabang.—The work in this direction progressed most satisfactorily at Alabang during the first three quarters of the year, but with the fourth quarter occurred an outbreak of surra from the effects of which the horse-breeding work at this station received a most serious check. The total number of cases resulting from this outbreak was 24, the last case occurring on June 16. Of this number 5 deaths were reported previous to the end of the fiscal year. Every possible precaution has been taken to prevent the spread of the disease and it is not likely that more cases will appear.

A total number of 20 foals have been dropped at the station during the year, and a total number of 157 services credited to the station studs.

A sufficient amount of Rhodes-grass hay has been produced on the farm to supply the entire needs of the station. During a portion of the year the brood mares and foals were pastured on paspalum grass, which appeared to be a palatable pasture of good sustenance.

La Carlota.—The horses at this station have been kept in very good condition throughout the year. All mares received a daily grain ration of about 3 kilos, and for a portion of the time green forage in the form of Guinea grass or cane tops, practically no hay being fed. A total number of 17 foals were dropped, 75 per cent of the mares foaling as against 40 per cent for the year previous.

The Arabian stallion No. 118 and native stallions L–53 and L–77 were at the head of the stud during the period.

CATTLE PROJECT.

The main object of this project is the production of improved breeding animals for disposal to the public.

The work under this project has been carried on at Alabang, La Carlota, and Trinidad, and the following classes or types were produced:

Alabang: Pure-bred Indian; Indian grades; Hereford grades.
La Carlota: Pure-bred Indian; Indian grades.
Trinidad: Galloway grades; Angus grades; Indian grades.

Alabang.—All cattle at this station were included in the three following herds with the stud sire as shown:

Herd.	*Sire.*
1. Pure-bred Nellore	Nellore, No. L–31
2. Chinese	Hereford, No. 313.
3. Native and grades	Hereford, No. 313. Indian, No. 398.

The pure-bred Nellore herd continues to thrive and during the past dry season, although the pasture was very sparce, no grain was fed to this herd and but very little cut forage. The condition of these animals at the end of the short pasture season is a very conclusive indication of the rustling qualities of this breed.

The Hereford grades from Chinese dams produced during the year were very promising calves, showing characteristics of the sire to a very marked degree; the only objection to these offspring was the slight wooly coat which makes them liable to tick infection.

Of all the mestizos or grade cattle produced at this station, the Nellore–Chinese and native crosses (offspring from Nellore sires out of Chinese and native dams) are the most satisfactory.

One objection to the Nellore breed is its extreme legginess and rangy body conformation. These grades, however, seem to be much blockier or beefy, more docile, earlier maturing, and apparently better rustlers. They are also much larger than the native or Chinese dams, and above all are immune or at least very highly resistant to rinderpest.

The total number of calves dropped at this station during the season was 32.

La Carlota.—At this station three herds are maintained, as follows: Pure-bred, Indian-Chinese, and grade or mestizo. Pure-bred Nellore bulls are used exclusively.

The pastures at La Carlota are very abundant and no trouble is ever experienced in maintaining the animals through the dry season. There were very few deaths from any cause among the cattle at this place during the year, both the pure-breds and grades keeping in the best of condition.

From data gathered at this station it was determined that pure-bred Indian heifers drop their first calf at approximately 36 months of age, Indian-mestizos at 30 months, and Chinese at 24.

A small herd of carabaos containing 12 cows and 1 bull is kept at this station. Eight calves are the get of this herd for the year.

The total number of calves dropped at this station during the season was 47.

Trinidad.—A Galloway grade herd of 28 cows and the Chinese herd numbering 18 aged cows, together with a large number of grade heifers, constitute the herds at the Trinidad stock farm.

All cattle at this place have done very well the past year, no grain or cut forage being fed excepting to the two stud bulls. The Galloway-Chinese grade herd was bred to the Nellore bull and the Chinese cows to the Angus bull.

For the first time in the history of the station the cattle have been kept practically free from ticks through frequent change of pasturage and the use of an arsenic dip.

The total number of calves dropped at this station during the season was 36.

SWINE PROJECT.

The raising of pure-bred Berkshire swine for disposal to the public for breeding purposes continues to be one of the most successful lines of breeding undertaken by the Bureau of Agriculture.

The features in which this phase of live-stock improvement excels some of the other lines of breeding are the comparatively small amount of capital necessary for the work, the short length of time requisite for the production of results, and the interest of the people in swine breeding.

The Berkshire breed has proved particularly well adapted for the upgrading of the native swine; the first cross shows a preponderance of the pure-bred characteristics and appears practically as well adapted to local conditions as the native stock.

The Alabang stock farm is the only station at which any considerable amount of work is attempted in this direction. The pigs at this station have, apparently, entirely recovered from the kidney-worm disease, which was found present in a number of individuals during the fiscal year 1912. Only three deaths have occured from this cause during the entire present year.

The pigs at the Lamao station at the beginning of the year were transferred in December, 1912, a part of the number being sold at Singalong and the remainder sent to Alabang for breeding purposes.

The demand for pure-bred pigs has been much greater than the Bureau has been able to supply. To meet these requests the breeding herd at Alabang has been considerably increased during the year, and an order has been placed in the United States for the purchase of 32 additional head of stud stock.

GOAT PROJECT.

The animals assigned to this project are confined to a small Spanish grade herd at La Carlota and a Maltese grade herd at Alabang, numbering a total of 119 head. These herds are the resultant crosses from the pure-bred Spanish and Maltese goats, imported by the Bureau a few years ago. With the death of two pure-bred Spanish animals at La Carlota the first part of the year, the entire number of pure breds from this importation had succumbed to a parasitic disease, the nature of which has never been determined.

The present grade herd is apparently free from this disease, and the percentage of increase for the year has been very high, especially at Alabang. Although these grades have subsisted well on the native pastures and are in good condition physically, they are very small in size; in fact, some of them are inferior in this respect to many pure-bred native goats. These animals, however, show many of the milking characteristics of the Maltese and Spanish pure breds, and they should form a very good foundation stock for the production of high-grade types by crossing with pure-bred sires of some good milk breed. To this end a requisition has been placed for five Swiss goats to be secured in the United States, and from the Alabang herd about 30 of the best females will be selected and mated with these pure-bred males.

SHEEP PROJECT.

Very little has yet been attempted by the Bureau in the line of sheep raising.

During the year this work has been confined to Alabang, where a small herd of imported Merinos have been maintained.

These sheep have been kept free from disease, not even a case of foot-rot appearing during the wet season. The fleece of the lambs born at the station during 1912 and that of the aged animals appears to be of good quality, and a good clip was taken from them in April of this year. On the other hand, no lambs from the 7 females of the herd have been dropped since April, 1912.

VETERINARY DIVISION.

PERSONNEL.

On July 1, 1912, there were on duty 41 veterinarians, 64 American live-stock inspectors, 223 Filipino live-stock inspectors, 1 pathologist (veterinarian), and 1 veterinary entomologist. On June 30, 1913, there were on duty 37 veterinarians (1 loaned to the Veterinary College and 7 on leave), 47 American live-stock inspectors, 237 Filipino live-stock inspectors, 1 pathologist (veterinarian), and 1 veterinary entomologist. This shows a decrease of 4 veterinarians and 17 American live-stock inspectors with an increase of 14 Filipino inspectors.

ANIMAL-DISEASE ERADICATION.

RINDERPEST.

At the beginning of the fiscal year rinderpest was prevalent both in the Visayas and on the island of Luzon. Eleven provinces with 35 municipalities were known to be harboring infection. Outside of Luzon, infection was found in the Provinces of Surigao, Capiz, and Iloilo. On Luzon the disease was confined to the Provinces of Bulacan, Isabela, Laguna, Mountain, Pampanga, Pangasinan, Rizal, and Zambales.

Of the provinces infected at the beginning of the fiscal year, Isabela, Pampanga, Pangasinan, and Zambales were known to be infected on June 30, 1913; Bulacan, Capiz, Iloilo, Laguna, Mountain, Rizal, and Surigao were cleaned up during the year, and no rinderpest infection had been verified in any of these provinces up to the close of the year.

Provinces not known to be infected at the beginning of the fiscal year, which became infected during the year and were regarded as free from the disease on June 30, 1913, are Agusan, Ambos Camarines, Antique, Bohol, Cavite, Leyte, and Tarlac.

Provinces not harboring infection on July 1, 1912, and which were known to be infected June 30, 1913, are Cagayan, Ilocos Norte, Ilocos Sur, and La Union.

The largest number of provinces considered as infected at any one time during the year was 12, recorded during the week ended November 11, 1912. The smallest number infected during the year occurred during the week ended May 14, 1913, only 7 provinces being infected at that time.

The smallest number of municipalities showing infection at any one time during the year was 18, which occurred during the week ended October 28, while the largest number, 35, occurred during the week ended July 1, 1912.

At the end of the fiscal year June 30, 1913, but 8 provinces, with 24 municipalities, are known to be infected, showing a gain of 3 provinces and 11 municipalities during the year.

Iloilo, Capiz, Antique.—The large force of Bureau employees which at the beginning of the fiscal year was combating the serious outbreak of rinderpest in the Provinces of Iloilo, Capiz, and Antique, on the island of Panay, succeeded in cleaning up the last infected municipality during the week ended January 6, 1913. During the campaign on this island the Philippine Scouts very ably assisted in the quarantining of infected municipalities. The infection in Iloilo and Capiz was widespread. At one time in the Province of Iloilo eight municipalities showed infection and at another time, in Capiz, seven municipalities were known to be infected. Had it not been for the hearty coöperation of the provincial and municipal officials, as well as the spirit of coöperation shown by the people themselves, it would not have been possible to have cleaned up this outbreak in such a comparatively short time. The Philippine Railway Company, operating in the Provinces of Iloilo and Capiz, assisted the Bureau very materially by granting free transportation to Bureau employees as well as carrying, free of charge, freight and supplies used in connection with the campaign.

Leyte.—During the week ended July 29 infection was verified in two municipalities in Leyte Province, and on August 4 four municipalities were infected. However, by September 30, 1912, the disease was eradicated. The Philippine Constabulary, on request, very promptly furnished 50 enlisted men for duty in the infected area. This force continued on duty until relieved by two companies of Philippine Scouts. As was the case on the island of Panay, the coöperation on the part of the provincial and municipal officials and the people in general in the infected municipalities of Leyte greatly assisted in cleaning up the infection.

Pampanga.—As the fiscal year closes, Pampanga Province presents the same difficult problem in the way of eradicating rinderpest that it did on July 1, 1912. There were on June 30, 1913, eleven municipalities in this province showing infection, while on July 1, 1912, but seven municipalities in Pampanga were known to be infected.

Bulacan.—During the week ended July 8, 1912, the last infected municipality in Bulacan Province was regarded as free from rinderpest. No more infection was reported from this province during the fiscal year. However, during the last week of June, 1913, several suspected cases of rinderpest were reported in the municipality of Hagonoy.

Ambos Camarines.—During the week ended January 13, 1913, an unknown disease, which caused the death of several cattle and carabaos in the Lagonoy district, Ambos Camarines Province, was reported. A thorough investigation of this outbreak was made and it was found to be rinderpest. A force of inspectors was employed and the veterinarian in charge instituted a rigid campaign against the disease, placing a close quarantine on all infected districts. On request, the Philippine Constabulary furnished enlisted men to be used as quarantine guards and the service rendered by these guards was very efficient. During the week ended March 14, 1913, the infection was considered as having been cleaned up and all quarantines were raised.

Agusan.—During the week ended March 14, 1913, rinderpest infection was reported in the Province of Agusan. The provincial officials, assisted by the Constabulary, took prompt action and placed effective quarantines in the infected districts, and the disease apparently did not spread outside of the limits of one municipality. On receipt of information that rinderpest existed in this province a veterinarian with several inspectors was sent to take charge. Under date of May 5, 1913, the province was reported as being clean.

Bohol.—Infection appeared in the Province of Bohol during the week ended November 18, 1912. A veterinarian with a force of inspectors was sent to the province and under date of January 6, 1913, reported no more disease. However, under date of March 14, reinfection appeared and on request, the Honorable the Secretary of Public Instruction issued an order placing a quarantine on the province. The provincial and municipal officials assisted the veterinarian in charge in every way possible and on May 12 the infection had been eradicated and as the fiscal year closes it has not reappeared. It is not desired, however, to raise the quarantine from the province until it is fully determined that the infection will not recur.

Cagayan.—Under date of February 3, 1913, rinderpest infection was reported in the Province of Cagayan. A veterinarian was sent to this province for the purpose of investigating to what extent the infection had spread. He made request for a force of insular inspectors, which it was not possible to furnish. The provincial officials also reported that the condition of provincial finances would not permit the employment of provincial inspectors for this work. At the present time there is on duty in Cagayan one veterinarian with one Filipino inspector. On June 30 there were two municipalities in Cagayan showing rinderpest infection.

Cavite.—During the month of November, 1912, infection appeared in this province. The provincial governor, who has full charge of the eradication of animal diseases in that province, took immediate steps to place quarantine on the infected municipalities and since December 16 no cases have been reported.

Ilocos Norte.—On November 11, 1912, the existence of rinderpest infection in this province was verified. As soon as possible thereafter a veterinarian was sent to Laoag to take charge of the work of combating the disease. There were no Bureau live-stock inspectors available to assist him. The provincial officials, however, were requested to furnish provincial live-stock inspectors and they authorized the employment of ten men. During the month of February, 1913, there were five municipalities in Ilocos Norte showing infection, but on June 30 but two municipalities were known to be infected. On account of the lack of properly trained inspectors it has not been possible to enforce the necessary quarantine measures to insure the cleaning up of the infection. Within a few months the rinderpest quarantine forces now working in the Province of Ilocos Sur will proceed northward into the Province of Ilocos Norte, when more rigid quarantine measures will be enforced.

Ilocos Sur.—During the month of November, 1912, rinderpest was reported in this province. In December a veterinarian with a large force of inspectors and Philippine Scouts was sent into Ilocos Sur and the diagnosis of the disease was verified. In January, 1913, no more infection having been discovered, the province was regarded as free. A thorough inspection of all municipalities in the province was inaugurated and during April new infection was discovered. The veterinarian who had charge of the work in La Union Province was relieved from duty there and, with the greater part of the forces which were working with him, was ordered to Ilocos Sur. As the fiscal year closes only one municipality in Ilocos Sur is known to harbor rinderpest infection. The provincial officials in this province have very heartily coöperated with the Bureau employees.

La Union.—In La Union Province rinderpest infection has existed in a greater or less degree since the early part of September, 1912, up to and including the close of the fiscal year. During the period from April 11 until May 26 this province was considered as free from infection. During October the rinderpest quarantine forces were operating in this province along the Pangasinan–La Union fence. They made a thorough inspection and quarantine of every municipality and barrio northward to the boundary line of Ilocos Sur. All rinderpest infection existing at that time was located and cleaned up. During the week ended May 26, infection appeared in the municipality of Rosario and is supposed to have been brought in from the Province of Pangasinan along the road to Camp One. Half a company of Philippine Constabulary and later a company of Philippine Scouts were made available for quarantine duty with the veterinarians and live-stock inspectors. As the year closes a very careful inspection and quarantine is being instituted in this municipality and surrounding barrios.

The quarantine fence between Camp One and Rabon, separating the Provinces of La Union and Pangasinan, has been very useful in preventing the free movement of animals between those two provinces. Two American and 12 Filipino inspectors continually patrol this fence and no person can move his carabaos or cattle past this fence without securing the authority of the veterinarian in charge.

Amburayan Subprovince.—During the week ended November 11, 1912, rinderpest infection was verified in Amburayan, a subprovince of the Mountain Province, and a veterinarian and a force of inspectors instituted a thorough inspection and quarantine. On March 1 this subprovince was declared free from rinderpest and remained so to the end of the fiscal year.

Pangasinan.—Pangasinan Province has harbored rinderpest infection during the entire fiscal year. On two occasions, once during the week ended September 2, 1912, and the other during the week ended June 23, 1913, this province was reported as free from disease. The week following in each instance showed that infection still existed. As the year closes two municipalities are known to be infected.

Rizal.—At the beginning of the fiscal year Rizal Province had a great deal of infection. During October and November the rinderpest quarantine forces made a very careful inspection of the different municipalities in this province. On their withdrawal from the province a small force was left to take care of the one municipality which remained infected. On February 10, 1913, this province was declared free from infection and has remained so to the end of the fiscal year.

Surigao.—At the beginning of the year one municipality in Surigao Province was known to be infected. Through the efforts of one American inspector, who succeeded in obtaining the hearty coöperation of the municipal and provincial officials, the province was declared clean under date of July 22, 1912. No known infection existed in the province at the close of the year.

Zambales.—Zambales Province has harbored infection during the entire fiscal year with the exception of the period from December 9, 1912, to January 13, 1913, inclusive. During October the rinderpest quarantine forces entered the province at the southern end and worked northward. Very little infection was found in the southern part of the province and in a short time it was cleaned up. After the forces moved to the northern part of the province infection was found in the municipality of Palauig. The disease spread rapidly and during the latter part of April and the beginning of May four municipalities were known to be infected. As the year closes only two municipalities are known to be infected.

Quarantines.—During the year the Provinces of Capiz, Leyte, Ilocos Norte, Ilocos Sur, Antique, Zambales, and Bohol were quarantined by order of the Honorable the Secretary of Public Instruction. The subprovince of Amburayan was quarantined by order of the Director of Agriculture. Orders previously issued, placing quarantine on the Provinces of Cagayan, Isabela, Pangasinan, Tarlac, Pampanga, La Union, Laguna, and Iloilo have been revoked and new orders issued. The Provinces of Rizal, Laguna, Nueva Ecija, Bulacan, and Leyte have been released from quarantine. Authority has been requested to have the quarantines at present existing in the Provinces of Iloilo, Capiz, and Antique removed.

Cases and deaths.—During the year the field force has reported 4,731 cases of rinderpest with 2,787 deaths. This shows an increase of 419 cases, but a decrease of 60 deaths, when compared with the same data for last year. Seventy-two per cent of the new cases and 70 per cent of the deaths reported occurred in three provinces, namely, Pampanga, 1,785 new cases and 1,335 deaths; Zambales, 1,212 cases and 449 deaths; La Union, 438 cases and 184 deaths. The remaining 1,296 cases and 819 deaths were divided among the 19 other provinces reporting infection during the year. The distribution of these cases and deaths by quarters is shown in Table No. 1 below.

TABLE NO. 1.—*New cases and deaths per week.*

	New cases.	Deaths.
First quarter	606	390
Second quarter	689	357
Third quarter	1,790	1,059
Fourth quarter	1,646	981
Total	4,731	2,787

The known amount of rinderpest infection at the beginning and at the end of the fiscal year and the number of political divisions involved are shown in Table No. 2 following:

TABLE NO. 2.—*Rinderpest statistics, beginning and end of fiscal year.*

Week ended—	New cases per week.[a]	Deaths per week.[a]	Provinces infected.	Municipalities infected.	Barrios infected.
June 29, 1912	23	19	11	34	69
June 28, 1913	76	54	8	23	71

[a] Cattle and carabao.

The distribution and amount of rinderpest found during the last eight days of the fiscal year is shown in Table No. 3. Under the heading "suspects" are included those animals in which diagnosis had not been confirmed and which were under observation. "New cases" include all rinderpest cases placed in the corrals during the period. "Convalescents" include all that have been in the corral over eight days.

TABLE No. 3.—*Rinderpest during last eight days of fiscal year.*

Provinces.	Suspects.		New cases.		Convalescents.		Deaths.	
	Cattle.	Carabao.	Cattle.	Carabao.	Cattle.	Carabao.	Cattle.	Carabao.
Cagayan				5		6		10
Ilocos Norte		14		7				1
Ilocos Sur	1							
Isabela								
La Union		20		8		38		4
Pampanga		2		30		39		27
Pangasinan			2	5	2		2	1
Zambales		7		7	41	68	1	3
Total	1	43	2	62	43	151	3	46

Under Table No. 7 (appendix) is shown the distribution of rinderpest cases and deaths.

FOOT-AND-MOUTH DISEASE.

This disease was found among some cattle brought into Manila from Indo-China; also a very severe outbreak occurred in the Province of Capiz. There were 576 cases among the Indo-China animals with 9 deaths. In Manila the infection did not spread beyond the corrals in which the animals were kept.

There were registered in the Capiz outbreak 480 carabao and 14 cattle as infected, with only 1 death. This province was reported free during April, but as the fiscal year closed notice was received of a reinfected municipality. (See Table No. 7, appendix.)

SURRA.

This infection has been reported in eight different provinces since July 1, 1912, but only a small number of cases and deaths have been registered. Requests have been received at different times from infected districts for the services of veterinarians to combat this disease, but owing to the rinderpest campaign being waged in the different provinces it has been impossible to assign any veterinarian permanently to this work. In one or two instances a veterinarian was sent to a badly infected locality for the purpose of explaining the procedure to be followed to prevent the spread of the infection. (See Table No. 8, appendix.)

GLANDERS.

A few cases and deaths have been registered in four provinces and in the city of Manila. This disease is known to be very prevalent in the island of Catanduanes, Albay Province, but there are no statistics to show to what extent it exists. At the request of the local officials in Albay Province a veterinarian was sent to Catanduanes Island for the purpose of inaugurating a campaign which would insure the final eradication of the disease. On account of the sickness of this veterinarian it has been necessary to suspend operations for the time being. (See Table No. 8, appendix.)

CONTAGIOUS PLEUROPNEUMONIA.

This disease is only found among cattle imported from Australia into the barrio of Sisiman, Bataan Province, to be slaughtered for beef purposes. In order to prevent the possibility of spreading the infection from this place to other parts of the Philippine Islands, an order was recently issued placing this barrio in quarantine.

MISCELLANEOUS DISEASES.

Epizoötic lymphangitis, anthrax, and hemorrhagic septicemia have been found in such a limited degree throughout the Islands during the year that special reports on these diseases are not warranted. (See Table No. 9, appendix.)

PHILIPPINE SCOUTS AND CONSTABULARY ON DUTY JUNE 30, 1913.

The following table shows the number of Philippine Scouts and Philippine Constabulary on duty with the Bureau of Agriculture at the close of the fiscal year.

	Officers.	Enlisted.		Total.	Provinces in which located.
		Noncommissioned.	Private.		
Philippine Scouts	25	149	727	901	Ilocos Sur, La Union, Pampanga, Pangasinan, and Zambales.
Philippine Constabulary	2	13	75	90	Nueva Vizcaya and Ilocos Sur.

The work of the Philippine Scouts continued throughout the present year to be of the same high order of efficiency as during the fiscal year ended June 30, 1912. Their duties, although of a very arduous nature, have been performed in an exceedingly creditable manner. Without the assistance of this organization it would be an exceedingly difficult problem to establish successful rinderpest quarantines.

The Philippine Constabulary have always been ready to cooperate with the veterinarians in every way possible. In several

Simultaneous inoculation at Iloilo, 1912. Inspector taking notes.

Isolation of animals in a barrio infected with rinderpest.

PLATE VI.

Corral for the isolation of animals infected with rinderpest.

instances whole companies have been placed in a newly infected district, which have held the quarantine lines until the Philippine Scouts could be made available to relieve them that they might return to their regular duties. Too much cannot be said as to the efficient service rendered by the officers and men of this organization when detailed on quarantine duty.

IMPORTATION FROM FOREIGN PORTS.

Only two shipments of cattle and carabaos have been imported into the Philippine Islands during the year from Indo-China. For other importations see Table No. 2 (appendix).

General Order No. 30, dated June 6, 1913, provides for ninety days' quarantine on lighters, cascoes, or other suitable vessels of all cattle, carabaos, sheep, goats, or swine imported from any foreign port considered and declared by the Director of Agriculture to be infected with a dangerous communicable animal disease. Animals received from foreign ports which are not covered by regulations may be landed in the Philippine Islands and subjected to a quarantine of thirty days. If brought from a foreign port for which no regulations have been promulgated, and accompanied by satisfactory proof to the effect that the country of origin has no dangerous communicable animal diseases and that they were not exposed to such diseases en route, animals imported into the Philippine Islands may be subjected to only a ten days' quarantine, provided no disease occurred among them while undergoing quarantine.

QUARANTINE STATIONS.

PANDACAN QUARANTINE STATION.

During the year there were 876 cattle and 287 carabaos received in this station, which, with the 207 cattle and 31 carabaos on hand at the beginning of the year, makes a total of 1,401.

One thousand one hundred and sixty of these animals were subjected to simultaneous inoculation, the results of which are shown in the following table:

Received.	Died before injection.	Date of injection (1912).	Serum per head.	Reactions.		Released.	Loss after injection.	
				Number.	Per cent.		Number.	Per cent.
			c. c.					
315	----------	Sept. 20	350	67	21	315	----------	----------
561	----------	Oct. 23	150	91	16	551	10	1.8
140	----------	Sept. 20	350	15	10	140	----------	----------
144	4	Dec. 20	300	37	26	136	4	2.8

Simultaneous inoculation.—In the report of this Bureau for the previous fiscal year statement was made to the effect that "the results do not encourage the belief that simultaneous inoculation of imported animals would be practicable." The greater part of the animals subjected to this treatment during the preceding fiscal year were at the time infected with rinderpest, which undoubtedly accounted for the large percentage of deaths. It would appear, however, from the results obtained during the present year that when healthy animals are given simultaneous inoculation, which was the case of those as shown in the foregoing table, that a very small percentage of deaths occur. (See Table No. 10, appendix.)

ILOILO QUARANTINE STATION.

This station was not used during the year for foreign cattle and carabaos. A veterinarian was on duty in Iloilo during the entire year for the purpose of inspecting animals entering and leaving the port from and to interisland points. This precautionary measure was deemed necessary in order to protect the Provinces of Iloilo and Capiz from possible infection.

SISIMAN MATADERO.

During the year 9,697 Australian cattle were brought into this station, and 9,646 passed for food purposes. Fifty-one carcasses and 3,666 parts were condemned. The total revenue derived was ₱68,853.52. (For causes of condemnation of carcasses and parts see Table No. 11, appendix.) Only one importer has, during the year, availed himself of the privileges of this matadero.

SAN LAZARO STATION.

During the year this station was used as a clinic by the College of Veterinary Science, University of the Philippines. It has also continued to serve as a station for the quarantining of horses infected with surra and glanders.

INTERISLAND SHIPMENTS.

There have been brought into Manila from interisland ports during the year 4,833 cattle and 1,171 carabaos. Most of these were animals from the Batanes Islands, although several shipments were brought from the Provinces of Ilocos Norte and Ilocos Sur. When they are brought in from these last two named provinces they are required to be quarantined for fifteen days before leaving those provinces. For the Province of Ilocos Norte, Currimao, and for Ilocos Sur Province, Salomague or Vigan, are the ports which were designated as those from which animals could be shipped. In all cases animals shipped from these ports had to be brought to Manila, and on arrival here were subjected to another ten days' quarantine before permits were issued for shipment to their destination. This interisland regulation is still in effect as the year closes. (See Table No. 2, appendix.)

INSPECTIONS.

Inspections for which fees were charged.—There were inspected on arrival in the city of Manila 73,982 animals of all kinds, for which fees amounting to ₱9,686.90 were charged and collected. Of these animals 63,812 were swine. (See Tables Nos. 3 and 4, appendix.)

Post-mortem inspections in Manila matadero.—There were 69,718 animals of all kinds inspected at the Manila matadero during the year, 917 being condemned and 68,801 being passed for food. (For further information see Tables Nos. 5 and 6, appendix.)

RESEARCH WORK.

Research work has continued during the past year being directed primarily toward the investigation of various problems associated with surra and rinderpest.

The veterinary entomologist has been conducting a series of experiments directed toward definitely determining the species of fly responsible for the dissemination of surra. Representatives of several genera of common horseflies were tested and eliminated as possible factors, but recently *Tabanus striatus* has been incriminated. The whole attention of the employees conducting the work may now be turned to the study of breeding habits, etc., with reference to devising more effective preventive measures against surra.

The veterinary pathologist devotes his attention largely to the pathology of rinderpest and clinical manifestations of the disease. He has underway a piece of work involving a very extensive study of the gross and microscopic lesions of rinderpest, a work which merges into the study of the problem of the etiology of rinderpest.

The study of the peculiarities of the transmission of rinderpest and viability of the infective agent under various conditions has yielded results of far-reaching value in guiding the quarantine measures enforced in the campaign in progress.

The completed research work is indicated by the following titles of papers published during the year, or which have been prepared and are awaiting publication:

Symptoms and Lesions Presented by Cattle and Carabaos Suffering from Rinderpest in the Philippine Islands. By William Hutchins Boynton, Philippine Agricultural Review, Vol. V, No. 12, 1912.

Collected Notes on the Insect Transmission of Surra in Carabaos. By M. Bruin Mitzmain, Philippine Agricultural Review, Vol. V, No. 12, 1912.

The Surra-conveying Fly of the Philippines and Some Factors Concerned in Control Measures. By M. Bruin Mitzmain, Philippine Agricultural Review, Vol. VI, No. 8, 1913.

Observations on the Clinical Diagnosis of Glanders. By C. H. Schultz, Philippine Agricultural Review, Vol. VI, No. 8, 1913.

Kidney-worm Infestation of Swine. By Wiliam Hutchins Boynton, Philippine Agricultural Review, Vol. VI, No. 8, 1913.

A Note upon Strangles in the Philippine Islands. By William Hutchins Boynton, Philippine Agricultural Review, Vol. VI, No. 8, 1913.

The Role of *Stomoxys Calcitrans* in the Transmission of *Trypanosoma Evansi.* By M. Bruin Mitzmain, Bulletin No. 24, Bureau of Agriculture, and Philippine Journal of Science, Sec. B, Medical Sciences, Vol. VII, No. 6, 1912.

A Note upon Strangles in Philippine Islands. By William Hutchins Boyton, Philippine Journal of Science, Sec. B, Medical Sciences, Vol. VII, No. 3, 1913.

The Biology of *Tabanus Striatus Fabricus.* The Horsefly of the Philippines. By M. Bruin Mitzmain, Philippine Journal of Science, Sec. B, Medical Sciences, Vol. VIII, No. 3, 1913.

A Note on the Mechanical Transmission of Surra by *Tabanus Striatus Fabricus.* By M. Bruin Mitzmain, Philippine Journal of Science, Sec. B, Medical Sciences, Vol. VIII, No. 3, 1913.

Kidney-worm Infestation of Swine in the Philippine Islands, with Special Reference to the Pathological Changes. By William Hutchins Boynton, Philippine Journal of Science, Sec. B, Medical Sciences, Vol. VIII, No. 5, 1913.

The Transmission of Rinderpest. By Archibald R. Ward, Frederick William Wood, and William Hutchins Boynton, Philippine Journal of Science, Sec. B, Medical Sciences, Vol. VIII, 1913.

An Atypical Case of Rinderpest in a Carabao. By William Hutchins Boynton, Philippine Journal of Science, Sec. B, Medical Sciences, Vol. VIII, 1913.

Notes on the Bionomics of *Lyperosia Minuta* and the Relations of this Fly to Experimental Surra. By M. Bruin Mitzmain, Philippine Journal of Science, Vol. VIII, 1913.

DIVISION OF AGRONOMY.

The work of this division includes investigations with rice, maize, sugar cane, grasses and forage crops, and cover crops.

Investigations with rice and maize have been confined to variety tests, seed selection, tests of cultural methods, and tests of fertilizers. Much of the work with grasses and forage crops has been confined to finding a grass satisfactory for haymaking, but tests for adaptability and yields are also carried on with a large number of crops that appear to be suitable for this climate. The work with cover crops has been confined to testing the various cover crops for amount of green matter produced per hectare, and plowing them under in order to note the effect on subsequent crops.

Rice.—The poorer varieties have been weeded out in the variety tests of rice which have been carried on for the past five years until now the Bureau has only 128 varieties of lowland rice of which 90 have given an average yield of more than 2,000 kilos per hectare as an average for two or more years. Twelve of the better varieties have been distributed to planters for the purpose of making tests under field conditions.

Two hundred and forty-seven varieties of upland rice, previously tested at Lamao, have been planted at La Carlota, Occidental Negros.

In order to clean all varieties of any red rice which might have become mixed in with the white, all the seed to be planted was passed over a plate of glass which had light reflected from below. By this method any colored grains could be easily detected and removed.

A preliminary test of thickness of planting seems to indicate that the yield may be increased by transplanting a larger number of plants on 1 hectare than has been the custom heretofore.

A second test of long-season varieties, grown during the dry season, from January until June, has demonstrated that those varieties requiring over one hundred fifty days to mature will not develop properly if grown at this season of the year. They seem to die down before sending up flower stalks.

Two fertilizers tests with rice have been conducted during the year, one with lime as the principal factor, and one in which an attempt was made to discover if the soil was deficient in any of the three principal elements—nitrogen, phosphoric acid, and potash. The results were nonconclusive. As this was the second year this work has been carried on with similar results both times, it would seem that fertilizers are not profitable when used on rice.

Maize.—Many tests have been made during the year with foreign varieties of maize. No variety has been found, however, which promises to be superior to the native varieties, when all things are taken into consideration. Some of the softer dent varieties will give heavier yields than the native kinds, but these soft varieties are quickly destroyed by weevils, hence they must be consumed at once or the grain is rendered worthless by the weevils. The "Moro," which is white, and the native yellow, commonly called "Laguna yellow," are perhaps our best varieties for average conditions.

A test of fertilizers with maize seems to indicate that it would not be profitable to apply chemical fertilizers to the maize crop under ordinary conditions.

In order to secure data upon the composition of the various kinds of maize being grown in the Islands, a collection was made of the different varieties and sent to the Bureau of Science for analysis. The following table gives the composition of seven varieties of Philippine maize:

Table showing chemical composition; analyses by Bureau of Science.

Name.	Moisture.	Fat.	Carbohydrates.	Protein.	Ash.	Crude fiber.	Total.
	Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
Laguna yellow	11.34	4.96	72.91	7.96	1.20	1.63	100
Mexican June	11.46	4.94	71.52	9.28	1.46	1.34	100
Moro	11.60	4.81	69.76	10.50	1.54	1.79	100
Cebu purple	11.00	4.38	71.61	10.17	1.03	1.81	100
Cebu white, small	11.50	4.42	70.94	9.45	1.73	1.96	100
Iloilo yellow	11.69	4.89	73.18	7.88	1.33	1.03	100
Iloilo white	11.32	5.96	70.55	9.10	1.53	1.54	100

Sugar cane.—The six Hawaiian varieties of sugar cane growing at Alabang were analyzed at intervals, after all the varieties had arrowed, to determine the best date for harvesting. The following table gives the data obtained:

Analyses of sugar cane.

Cane No.	Polarization.				Purity.			
	Jan. 20.	Feb. 12.	Feb. 24.	Mar. 5.	Jan. 20.	Feb. 12.	Feb. 24.	Mar. 5.
H-16	10.87	12.9	14.7	16.9	79.9	83.4	86.0	86.0
H-20	15.95	16.6	17.3	19.3	87.7	87.6	87.5	91.3
H-27	14.10	15.8	13.1	15.5	84.3	86.3	80.0	85.2
H-69	13.85	15.7	14.5	13.8	63.9	86.4	84.9	83.7
H-227	14.10	15.7	15.9	16.6	84.8	86.7	85.1	88.0
H-309	11.40	14.2	14.6	16.1	81.3	80.9	84.5	87.4

These varieties were planted on rather stiff clay underlaid with limestone rock. The average yield of cane was about 110 metric tons of stripped cane per hectare. A similar test was made of the same varieties growing at La Carlota, Occidental Negros, with about the same results as given above.

The larger Hawaiian varieties are becoming more popular now that a number of centrals are in operation which are able to handle these large canes as well as the smaller ones.

Grasses and forage crops.—Work with grasses has been rather discouraging owing to the fact that much of the seed purchased for planting new seed beds failed to germinate. As a result of this we have failed to secure a large area of Rhodes grass for haymaking. The hay that has been made from the area planted last year has proved satisfactory in every way.

Sudan grass grows entirely too large for haymaking and if sown thickly the blades are destroyed by rust. As a green forage crop it does not compare with some of the sorghums or Guinea grass.

Nonsaccharine sorghums do fairly well when planted during the dry season. Black hull white kafir gave a yield of 40,228 kilos of green forage per hectare; dwarf milo gave a yield of 35,743 kilos of green fodder per hectare; red kafir gave a yield of 34,791 kilos of green fodder per hectare; and pink kafir gave a yield of 38,189 kilos of green fodder per hectare. When these varieties were planted so that the greater part of their growth was made in the rainy season, the yield of green fodder was only about one-third of the amounts recorded above; while the yield of seed during the dry season was reduced more or less by the ravages of insects (principally plant lice) and plant diseases, it was practically nil during the rainy season.

LA CARLOTA EXPERIMENT STATION.

The production of sugar on a commercial scale has been discontinued at La Carlota. The principal operations of this station for the past year have been with fiber crops (reported under the fiber division) and experimental work with different varieties of sugar cane.

Sugar-cane experiment No. 1.—The plats containing the 6 varieties of Hawaiian canes planted in the nursery in front of the dwelling house in July, 1911, with seed cuttings from Alabang, having become mixed, they were plowed up and the stools destroyed. From these plats a neighboring planter was given all the points of H–27 and H–309.

Sugar-cane experiment No. 2.—This plat used for the comparison of varieties was planted January 25, 1912, in the northeast corner of the experiment cane field. It consisted of the 13 varieties named below, three rows of each, 1.37 meters apart and 15.2 meters long, 40 points being placed in each row and one row left vacant between the varieties. The seed points of the "H" varieties were received from Alabang, "Formosa" from Hacienda Esperanza, and the balance was grown at this station.

H-27, H-309, H-227, H-16, H-20, H-69, Negros, Striped Louisiana, Formosa, Lahaina, Yellow Caledonia, Rose Bamboo, and Inalmon were grown on these plats. Canes from these plats were analyzed in the Iloilo sugar laboratory. These plats are now ratooning and will be known as "continuation of sugar-cane experiment No. 2."

The determination of the yield of ratoon cane from some of these plats is precluded for the reason that the storm of October, 1912, left a large part of the cane on the ground. This cane took root and formed new stools between the rows. To prevent the possibility of the varieties becoming mixed, it was necessary to destroy a portion of some of the plats.

Sugar-cane experiment No. 3.—Fertilizer test occupies the southern two-thirds of the experimental cane field. This experiment consists of 30 one-fortieth hectare plats, planted in duplicate with native Negros cane and fertilized. The planting was done December 10–19, 1912. Each plat is 10 by 25 meters and contains seven rows of cane 1.43 meters apart. Each row contains 60 points. This is at the rate of 16,800 points per hectare.

Sugar-cane experiment No. 4.—This plat used for comparison of varieties is located in the nursery in front of the dwelling house. All seed is grown at this station except "Tigbao Mestiza," which was found at Hacienda Najalin. It consists of one plat containing one line of each of 14 varieties. The rows are 1.37 meters apart and 16.46 meters long. Forty selected points were planted in each line February 7, 1913. This is at the rate of 17,740 per hectare. This plat was located in the nursery to better protect it from rats, dogs, and stray hogs. From this plat most of the laboratory tests will be made during the coming year.

The varieties planted are Negros Purple, Yellow Caledonia, Formosa, Inalmon, Tigbao Mestiza, H-309, H-27, H-69, H-20, H-16, H-227. Adjacent to, and as a continuation of this plat, are the four "Luzon" varieties and D-1136, but as they were planted at different dates they cannot enter into this test.

During the past planting season requests for cane points of imported varieties were received from ten different planters. This indication of a growing interest in improved varieties on the part of the planters is encouraging.

Measurements showing the growth of sugar canes in "sugar-cane experiment No. 4," planted February 7, 1913.

	Mar. 22.	Apr. 10.	May 3.	May 13.	June 16.
	Meters.	*Meters.*	*Meters.*	*Meters.*	*Meters.*
H-227	1.01	1.39	1.53	1.83	2.61
H-16	.80	1.22	1.60	1.88	2.63
H-20	1.02	1.22	1.24	1.63	2.64
Rose Bamboo	.70	1.42	1.98	2.16	3.06
H-69	.84	1.29	1.47	1.60	2.30
Tigbao	1.12	1.51	1.88	2.31	3.26
Formosa	.63	1.37	1.65	1.78	2.39
Lahaina	.93	1.14	1.32	1.67	2.92
Inalmon	.91	.99	1.55	1.78	2.51
Yellow Caledonia	.96	1.29	1.98	2.33	3.11
H-27	1.03	1.50	1.65	1.75	2.79
Striped Louisiana	.76	1.17	1.78	1.98	2.61
H-309	.53	1.32	1.57	1.93	2.34
Negros	.94	1.22	1.70	1.98	2.82

DIVISION OF HORTICULTURE.

The work of the division of horticulture includes the supervision of the Singalong experiment station, the Lamao experiment station, and the Ilagan tobacco station; seed and plant introduction and distribution; the locust campaign, and other entomological work; and all horticultural investigations.

During November, 1912, a photographic office was instituted in the division of horticulture. It is estimated that this office is now turning out work at less than one-half the cost for the same work done outside the Bureau. During the fourth quarter no less than 3,000 prints have been made, besides the other routine work.

The work of collecting market reports and horticultural crop statistics has been carried nearly to a close during the year. The records and statistics obtained are being tabulated and the results will be ready for publication during the coming fiscal year. This is the first census to be made, so far as known, of Philippine fruits. These market reports show in detail the cost and the regular season of each fruit and vegetable to be found in Manila.

Official inspection trips have been made to Mindanao and the southern islands by the chief, the horticulturist, and the assistant horticulturist. The entire staff of the locust office, with the exception of the clerks, have made tours of inspection in the Visayan Provinces, in Palawan, and in southern and central Luzon.

Exchange relations have been maintained with 58 agricultural or botanical stations in 28 foreign countries and from nearly all of these exchanges valuable material has been, or probably soon will be, received. An exchange of agricultural photographs has also been organized with several foreign countries.

SINGALONG EXPERIMENT STATION.

About 2,000 tests of over 1,000 varieties of vegetables and forage plants more or less adapted to Philippine conditions have been made during the year at Singalong. Simultaneously with the vegetable tests it was found expedient and economical to run a number of ornamental tests in ground which was not at that time occupied by the vegetable tests. This feature has furnished some of the most striking results obtained; several hundred first-class varieties of cannas, dahlias, and hardy bulbs capable of enduring the Manila climate have been introduced into the Philippine flora. Many of these, like the canna, are a very great improvement over the three or four old varieties which were in evidence before the Singalong tests began, and are as readily propagated. These ornamentals which have been propagated at very little expense will be distributed to various Government institutions, such as hospitals, the larger schools, demonstration farms, city plazas, etc., throughout the Archipelago during the coming fiscal year.

The most important part of the propagation work at Singalong has been the germination and growing of seeds and plants for the Lamao experiment station. During the year about 200,000 seedlings have been raised in the main propagation shed. There are now 1,700 varieties of seeds and plants in process of propagation in about 250 flats, or seed boxes, and beds, besides 300 varieties of plants in the sheds themselves. Besides the very large number of miscellaneous seeds and seedlings sent from Singalong to the Lamao experiment station, the records show that no less than 11,458 plants have been furnished Lamao from the propagation sheds of Singalong. It is estimated that the total number of roots, bulbs, cuttings, and living plants handled and distributed this year from the Singalong propagating sheds is upwards of 400,000, exclusive of mulberry cuttings, yam tubers, taros, and vegetable seeds.

During the fourth quarter a temporary half-shade bamboo shed was provided for housing the rapidly growing orchid collection. This shed now contains upwards of 600 plants which are being "settled" and fed up, to be used later as exhibits in the exposition in 1914.

The principal economic collections now in evidence at Singalong are the following:

A collection comprising over 50 numbers of yams; this represents the old Philippine yam collection combined with a number of excellent new varieties received during the past year from foreign countries. The surplus material from this collection was sent during the second quarter to the Lamao experiment station for wholesale propagation, three typical specimen plants of each variety being retained for synonymy and botanical study.

Besides the old collection of taros, dasheens, and yautías, 9 varieties new to the Philippine Archipelago have been received from the United States Department of Agriculture. The 14 principal economic varieties of this group of rootcrops, most of which are new to the Philippines, are now being propagated on a large scale for future distribution; a considerable number of presumably valuable sorts are under test.

Nearly all of the bananas which are to be tested under project 29 at the Alabang stock farm must needs pass through the Singalong propagating sheds; over 200 varieties and species have been put into proper shape for distribution at Singalong and 134 of these have been permanently set in the trial ground at the Alabang stock farm.

Excellent success has been met with in the propagation of newly introduced varieties of mulberries, and at the close of the year a large stock is ready for permanent planting and wholesale propagation at the Lamao experiment station. There seems to be no question that three if not five of the new varieties will prove greatly superior to the varieties distributed to silkworm raisers during the past year.

On the whole, there have been remarkably few negative features in evidence at Singalong during the past year; on the other hand, an unexpectedly high percentage of successes—considering the difficult nature of much of the work—has been obtained. The cost of the work has been remarkably low and the future importance of it will be more in evidence during the coming two or three years.

LAMAO EXPERIMENT STATION.

The cultivable portion of this station has been divided into 7 natural fields and these again into 14 subdivisions in order to differentiate the various lines of work more thoroughly than heretofore. The propagation work is rapidly assuming very large proportions and with the coming popularity of citrus fruits throughout the Archipelago every effort is being made to test, propagate, and distribute a very large number of the best citrus fruits in the world. The work on the mango orchard has not progressed far yet on account of the pressure of other work, but this and work with the spices, bananas, mulberries, etc., will begin early in the coming fiscal year.

Among the fruit collections now most in evidence is that of the Annonas and Annona hybrids. Mr. Wester has made a special study of these fruits, which bid fair to be of the highest importance in the future horticulture of the Philippine Islands, and already a number of promising crosses between the Philippine and introduced species have been made. The most important of these hybrids are the 23 Cherimoya-sugarapple crosses which were large enough to fruit this year, but which were "set back" on account of their being transplanted into a permanent plat during the third quarter.

The miscellaneous tropical-fruit collection has been greatly increased during the year and now contains representatives of nearly all of the best tropical fruits of both the Western and Eastern Hemispheres.

The citrus collection has been started in plantation form, the trees being set 8 by 4 meters. Two trees of each variety on the same stock are planted with the expectation of removing every other tree as they attain full size. In the main field a variety of promising stocks will be tested in order to determine the degree of congeniality between the bud, or scion, and the stock plant. Most of the stock species under test are native to the Philippines.

Twenty-seven varieties of Philippine citrus fruits are in the nursery awaiting transfer to the test orchard, while 44 citrus varieties collected in the Philippines are already in evidence in the permanent field. All the standard citrus varieties of America and India are now under observation and most of the European varieties will soon be in evidence. The collection of citrus seedlings comprises some 90 numbers, probably more than one-half of which belong to different types of citrus fruits and most of which require nothing but good horticultural treatment to develop their innate good points, which means that in this seedling collection there are undoubtedly several fruits of first-class value which will be not only of much interest to the scientist but of profit to the producer. It is expected, moreover, that fully 75 per cent of the introduced varieties of oranges, lemons, limes, and pomelos will prove adaptable to Philippine conditions.

Previous public opinion to the contrary, it has been practically proved that there are no peculiarities about the climate or soil of the Philippines to preclude the successful practice of shield budding of even such difficult species as the tamarind, cashew, custardapple, soursop, etc.

The pineapple collection comprises Cayenne, Spanish, and Queen plants in large numbers for distribution, and at present the varieties Abakka, Sugarloaf, and the famous new Webber hybrids will be forced as rapidly as possible.

Some 400 avocado seedlings are being grown as stocks in anticipation of the receipt of a very large collection of avocado budwood of the best varieties in the world from the United States Department of Agriculture.

Of the mango collection received from India last year 21 varieties are now growing in the plant shed and are being inarched onto stronger stocks—a very necessary procedure—as rapidly as possible; these India mangos, together with a collection now at the Singalong experiment station, will be transferred soon to the permanent mango orchard.

The papaya breeding work has progressed during the year to a point where wholesale distributions of seed of a superior new hermaphrodite variety (showing almost no male plants) are being made. Several new methods of propagation are being tested; and a new type of these fruits has been discovered.

The very large collection of vanilla varieties was transferred from Singalong to Lamao in the fourth quarter. A field has been reserved for a trial vanilla plantation where shade or nurse trees will be tested, and at the end of the coming fiscal year it is probable that definite information concerning vanilla culture in the Philippines can be given out.

The propagating sheds and nurseries contain a vast number of plants of the principal economic fruit trees of the Tropics. There are now 1,300 budded citrus trees with over 12,000 seedling stocks awaiting buddage, besides some 6,700 plants of miscellaneous sorts.

The mulberry field has been remodeled and the old trees which have been badly weakened by repeated pollarding (for distribution of mulberry cuttings) are now in a way to rejuvenate themselves within a few months. The old variety (655 trees) is being replaced by the new varieties as rapidly as possible. Already 150 plants of new varieties are in place. Some 30,000 mulberry cuttings were distributed during the year.

Little experimental work has been done with the fiber plants, although about 20,000 maguey suckers, 4,300 sisal suckers, and 30,000 sisal bulbils have been distributed from the station.

About 100 varieties of vegetables have been tested, mostly in large plat form, during the year, and of the beans, okra, etc., a considerable quantity of produce has been turned back to the central office at Manila for general distribution. Considerable work has also been done with new cover crops, the idea being to publish the results of these tests and to grow seeds in bulk for general distribution during the coming year. The yam collection now includes 70 accession numbers and occupies a space of 1,260 square meters. The preliminary tests of the Singalong experiment station are being continued at Lamao and surplus material, of which there will soon be a great quantity in evidence, will be utilized in the regular plant and seed distribution work of the main office. Work with roselle has progressed very well, indeed, and 43 kilos of seed are now ready for distribution. Several fiber varieties of this popular crop have been tried out.

ILAGAN TOBACCO STATION.

Throughout the year coöperative demonstration and extension work in Isabela and Cagayan Provinces has been maintained through the station's traveling inspectors. Some work in the way of experiments and tests with vegetables, maize, tobacco, etc., at the station in Ilagan has been undertaken.

The cultivable ground at the station has been platted into separate fields, and careful records are kept of the crop tests in each of these areas. Incidentally, several hundred packages of vegetable, flower, and forage seeds have been distributed from the Ilagan station to Filipino planters in the valley; and seventy-six planters selected as collaborators have been furnished with seed maize. Besides detailed instruction in tobacco growing, the traveling inspectors advise and instruct the Filipino planters in maize culture, vegetable growing, and selection of seed.

SEED AND PLANT DISTRIBUTION.

The seed-distribution office has carried considerably more seed stock than during the previous year. The varieties of seeds handled have been about trebled and the quantity has nearly doubled that of the previous year. Special attention has been given the needs of planters having a considerable area under cultivation. The number of special collections distributed to provincial governors, supervising school teachers, hacenderos, and planters collaborating with this division is something over 1,600. The quantity of material in these special collections varies from 50 packages of seeds to bulk lots of 25 or more kilos (representing a very considerable expense), but it is believed much more good to the agriculture of the Philippines has been done through this system of distribution than through all the other methods combined, for the reason that the recipients have been intelligent planters, keenly interested teachers, or Government officials who were active in developing interest in new vegetables and forage crops among the planters in their districts.

About 12,000 collections have been mailed upon request from this Office; this represents about 125,000 packages of seeds, most of which were vegetables that had been tested and found adapted to Philippine conditions. One thousand six hundred forty-seven collections of seeds were called for at the mailing room of the central office in Manila. The provinces requesting the most collections were, in order of importance: Pangasinan (2,022), Ambos Camarines (1,331), Bulacan (1,270), and Union (1,138).

Besides the seeds purchased abroad for distribution through this Office, a very considerable quantity grown at Lamao has also been handled and much is still in stock for the coming fiscal year. Some 30,000 cuttings of mulberries have been distributed through this Office, together with about 1,000 pineapple suckers, some 28,000 sisal bulbils, and several thousand maguey and sisal suckers.

The germinating tests of seeds of uncertain quality are made both at the Singalong experiment station and at the central office. In this way very little seed that does not germinate above 75 per cent is allowed to go into general distribution. Most of the adverse reports concerning the germinating qualities of the seeds distributed by this Office have been found to be unreliable; that is, through accident or ignorance on the part of the recipient the seeds were either *prevented from germinating* or the seedlings were killed within one or two days after germinating. Very few complaints have been received concerning the seeds distributed during this year—a considerable improvement in this respect over last year; on the other hand, many complimentary letters have been received from provincial officials and prominent planters indicating the reliance placed by them on the materials sent out by this Office.

BANANA AND TROPICAL-FRUIT COLLECTION.

At present some 134 varieties of bananas and plantains are in evidence in the Alabang collection. Another large lot is due to be set out very soon. Of the more important varieties space for three stalks is reserved; for others only one or two stalks are allowed. On account of the rapidity with which this collection has been built up the space reserved has already been filled and a part of the ground set apart for the permanent tropical-fruit collection has been set with bananas.

Circular letters have been sent out to municipal presidents in districts which it is believed may contain varieties of bananas not found in central Luzon. Replies and materials are beginning to come in at the close of the year in answer to these requests. Letters have also been sent to horticulturists and planters interested in bananas throughout the Old World Tropics. Through the regular exchanges of the Bureau and by means of these letters requesting special exchanges in the line of bananas it is believed a nearly complete collection of the world's best bananas and plantains can be assembled within three years. Already over 200 numbers have been listed, care being taken not to give two numbers to one variety unless the names are so very distinct that there is little chance of their being synonymous.

There are two objects in making this collection of bananas—the working out of the synonymy of the varieties, which it seems has never been done by any country to date; and a thorough test of economic varieties for their commercial possibilities. It is believed there is an excellent opportunity here for banana cultivation on a large scale and no tests of the apparently suitable varieties having been made thus far, it is impossible until the close of work under this project to make any definite conclusions. There is not much doubt but that the present collection is the largest collection of economic Musa varieties in the world.

TROPICAL-FRUIT INVESTIGATIONS.

The principal feature of the work of this division is without question the citrus investigations. Practically all the citrus work is now confined to the Lamao station, although in some cases difficult propagation work has been conducted at the Singalong experiment station. The most important introduction is believed to be the seedless Siamese pomelo introduced during the first quarter by the assistant horticulturist.

Another collection of inarched mangos has been received during the third quarter from Calcutta, India; this collection which arrived in a precarious condition is still at the Singalong experiment station. Preparations have been made for extensive mango propagation during the coming fiscal year. The India mango varieties received during the previous fiscal year are now being propagated at the Lamao experiment station.

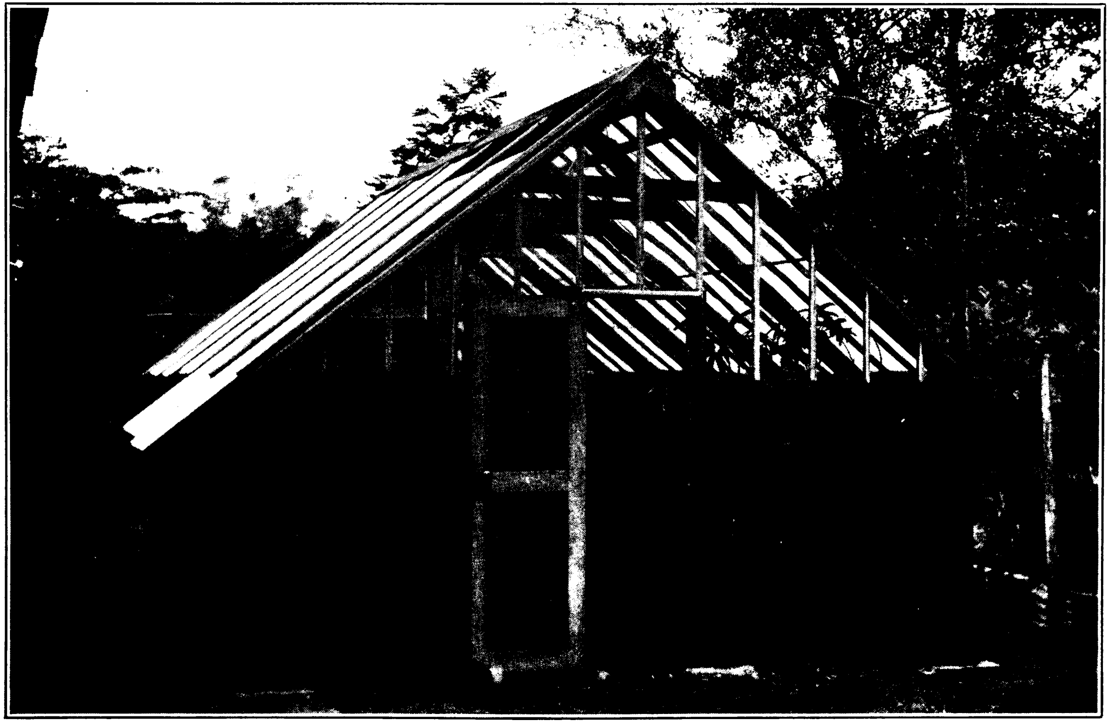
The collection of avocado varieties (46 distinct sorts) received during the first quarter has not progressed favorably.

Moro maize at Singalong experiment station yielding 9,750 liters per hectare.

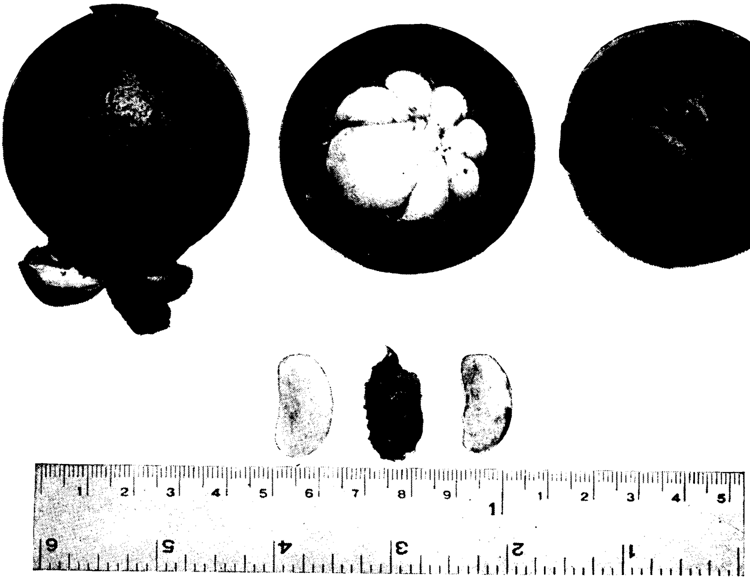
PLATE VIII.

Mungo grown as a cover crop in rice field during dry season.

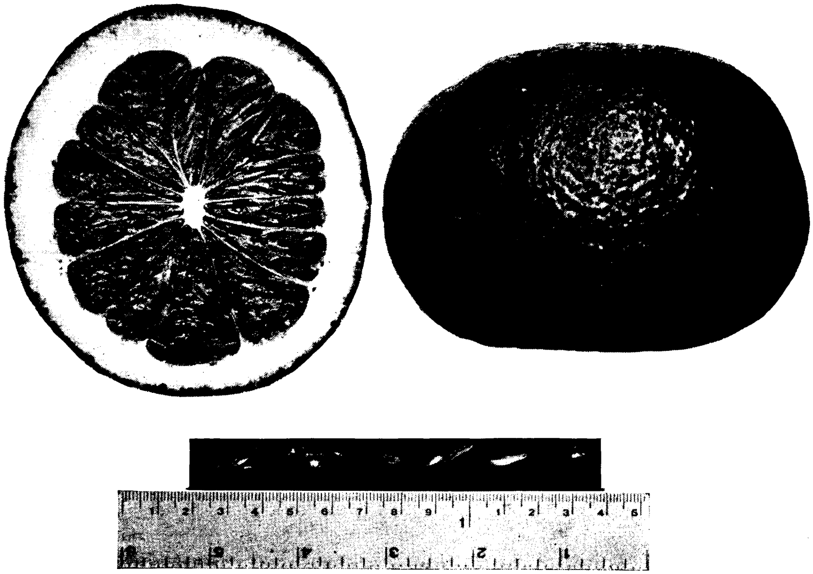
PLATE IX.



Propagating house at the Singalong experiment station; for valuable plants which require special treatment (constant humidity and even temperature).



(*a*) Mangosteen (*Garcinia mangostana*), Dumaguete, Oriental Negros. The world's best fruit.



(*b*) Siamese seedless pomelo (*Citrus decumana*) recently introduced from Siam. One of the excellent varieties which, it is believed, will revolutionize the pomelo industry of the world.

Due to improper stocks, lack of irrigation facilities, and a very dry period at the time of budding; most of this collection was lost. It is expected the collection will be duplicated early in the coming year. A considerable number of surplus seedlings have been distributed from the Lamao and Singalong experiment stations. A new lot (500 fruits) has also been ordered from Hawaii.

The papaya work is progressing favorably. Selective work with seedlings has been continued throughout the year and a variety carrying about 95 per cent of hermaphrodite plants has been "fixed." Seeds of this variety are now being sent out to schools and planters. The old plantation at the Alabang stock farm is still under observation.

No special banana investigations have been made thus far, but as soon as the large collection at the Alabang stock farm begins to fruit, technical work carried under this project will begin.

Beyond the propagation of a number of cacao seedlings for future investigations no special work with this crop has been done this year. The collection of pineapples is gradually increasing and distribution is now being made of the Queen; the Cayenne and Spanish varieties will be in condition for distribution during the coming year.

ROOT CROPS AND VEGETABLES.

The collection of yams at both the Singalong and the Lamao experiment stations is gradually increasing, and of most varieties suitable for distribution a large stock is now being grown for the coming year's work. The aroid collection maintained at Singalong thus far will soon be in condition for general distribution. Of the native Philippine vegetables special attention has been given the asparagus pea, or "seguidillas." A large number of seeds of this interesting vegetable have been grown at Lamao and are now being distributed.

SPICES.

A collection of vanilla varieties believed to be the largest in the world has been transferred from Singalong to the Lamao experiment station. A small plantation has been started with the object of testing the suitability of various shade trees for this valuable crop. A few of the spices, such as cardamum, cubeb pepper, black pepper, etc., have been received and will be propagated as rapidly as possible.

APICULTURE.

During the first quarter one weak colony was received from Hawaii and during August six colonies were received from Guam. These latter were in much better condition than the first lot and it has been arranged now to have another shipment come during the first quarter of 1914 from the Guam experiment station. There are now at the Lamao experiment station five colonies in fair condition. An apiary was constructed at Lamao during the second quarter. At present there are at the Alabang stock farm two colonies in fairly good condition.

Thus far it appears that the imported bee colonies have no pests or diseases and the future outlook is very favorable for the successful introduction of bees throughout the Philippines.

LOCUST EXTERMINATION.

The work of the locust office, while maintained from specially appropriated funds outside of the Bureau's regular appropriation, has been throughout the year under the charge of the chief of the division of horticulture. In the first quarter of this year both the entomologist and the assistant entomologist made extended tours through the infested provinces and at intervals this policy of periodical trips of inspection has been followed. In the latter part of the fourth quarter two agricultural inspectors were transferred from the veterinary division to assist in the control of the locust pest.

During the fourth quarter very severe outbreaks of migratory locusts appeared in eastern and southern Luzon, coming apparently from northern Tayabas. By June 1 practically all the provinces of central and southern Luzon, with the exception of Zambales, had been invaded by flying swarms and at the close of the year not only these provinces but practically all others (33 out of 38) were infested more or less with one or more species of locusts. In some provinces, such as Tarlac, Nueva Ecija, and Rizal, the infestation is so wide spread that it must necessarily be a question of months, if not years, before the uncultivated fields and cogonales are completely cleared of the breeding swarms which, although quite exterminated in the cultivated areas, persist in these back districts and resist all regular measures of control.

During May and June a thorough study of the two species of bacilli parasitic in the migratory locust has been carried out in collaboration with the Bureau of Science, the Bureau of Agriculture furnishing from one to three men and the many thousand living specimens of locusts for the laboratory experiments, while the Bureau of Science furnished the laboratory apparatus, exclusive of breeding cages, etc. Neither the so-called *Coccobacillus acridiorum* of the Pasteur Institute nor a similar microbe discovered in dying grasshoppers taken at Alabang have given consistently satisfactory results in the field. During June a full series of experiments with cultures of these bacilli were carried out in the vicinity of Cabanatuan, Nueva Ecija, but with a few exceptions the vitality of the bacilli outside of laboratory conditions deteriorates so rapidly that this very interesting and promising method of locust control has been abandoned as a general measure. Whereas laboratory methods were potent in securing the destruction of practically any number of individual locusts within a few hours after inoculation, on only two occasions in the field tests did the experimenters succeed in contaminating entire swarms under natural conditions.

MISCELLANEOUS ENTOMOLOGICAL WORK.

Aside from the locust-destruction work a large amount of insect-pest work has been carried out by the locust office. Considerable work has been done in white ant, or termite, control methods. Several new coconut pests have been studied, their life histories worked out, and, in one case, that of the leaf-miner (*Promecotheca cumingii* Baly), published in the Review and reprinted in the Philippine Journal of Science.

An article on the tobacco-leaf caterpillar (*Prodenia litura* Fabr.) is in press. An important piece of work with the mango bark-borer (*Plocaederus ruficornis* Newm.) has been performed and a very destructive pest to one of our most important fruit and shade trees has been controlled just in time to prevent very severe losses. Several other mango pests have been investigated. Maize and rice insects have come in for a fair share of the locust office investigations, while shade-tree and garden-truck pests have been given a moderate amount of attention. Two new citrus pests and a banana rootborer have been studied and considerable matter is nearly ready for publication. Over 700 insects have been added to the economic collection and sets of these for determination have been and are being sent to the United States Bureau of Entomology, Washington, D. C., for determination.

FIBER DIVISION.

The work of the fiber division includes investigations pertaining to abacá, agave, and allied fibers, kapok and allied flosses, cotton, Philippine hats and mats, and miscellaneous fibers. These general lines of activity are carried on by two methods of procedure, namely, experimental and field investigations.

ABACÁ (MANILA HEMP).

Abacá varieties.—This study was commenced during the fiscal year 1910, and has been continued until the present time. During 1910 and 1911 the study was restricted to the determination by field investigations of the varieties in each of the chief abacá districts, which was intended to serve as a basis for a more comprehensive study by means of experimental planting of the principal varieties from some of the above-mentioned districts at the La Carlota experiment station. The object of such work is fourfold: First, to determine accurately the distinguishing characteristics of each of the varieties; second, to determine whether or not the varieties of one district are identical with those of another; third, to determine to what extent, if any, the change of environment affects the growth of the plants and the quality of the fiber; and, fourth, to show whether the varieties reproduced from seed will exhibit the same characteristics as when reproduced from rootstocks.

During the fiscal year 1912 rootstocks from the most widely cultivated varieties of southeastern Mindanao and northeastern Leyte were secured and planted at the La Carlota experiment station, each in a separate group of plats. Seed from each of the varieties of southeastern Mindanao was also obtained at the same time as the rootstocks, and was germinated in a nursery.

During the year covered by this report the seedlings of the above varieties were transplanted to a group of plats opposite the one in which the same varieties from rootstocks were previously planted. Seeds from the ten Leyte varieties were also obtained and germinated in a nursery. In addition to the above, rootstocks from eight varieties from Ambos Camarines, namely, Pula, Itom, Puti Tomatagacan, Bulao, Ilayas, Sinamoró Puti, Canorajon, and Sugmod, and also rootstocks from five varieties from Occidental Negros, namely, Kinisol, Kala-ao, Bisaya, Lonó, and Moro, were secured and planted in two groups of plats in the same manner as the southeastern Mindanao and Leyte varieties. Seed from the Camarines and Negros varieties was also obtained and germinated in the nursery, and the seedlings will be later transplanted each to a group of plats set aside for them.

With the exception of the failure to germinate the seed from the Bangulanon and Sinabá varieties of southeastern Mindanao, from the Laguis, Liajon, and Ite-hen-Balud varieties of Leyte, and from the Ilayas and Pula varieties of Ambos Camarines, the plants from rootstocks and the seedlings have all made very fair progress, notwithstanding the drought and typhoons that have occurred during the year. The periodical use of the cultivator, the planting of leguminous cover crops, and periodical irrigation during the dry season have been resorted to and have proved to be indispensable methods of culture especially during such adverse circumstances as have been encountered during this year and the latter part of last year.

Of all the varieties which have been planted at La Carlota, the Mindanao varieties alone are now old enough to begin to exhibit some of their distinguishing characteristics. During the next fiscal year, it is believed that the Leyte varieties will be old enough to permit of a comparative study with the Mindanao varieties.

Cultural methods.—The improved methods of culture which have from time to time been recommended by this division have not yet been as widely adopted as might be desired. The severe drought of 1912 afforded a splendid object lesson in favor of the use of modern methods of culture, it having developed that, in the districts where the majority of the plantations were severely damaged, the well-managed plantations resumed their normal condition of growth and production in a comparatively short period. It has also been demonstrated that the damage to the abacá plantations during and subsequent to the drought was due more to utter neglect of the plantations in some cases and to the practice of ruinous methods of culture and harvesting in others than to the actual effects of the drought itself.

The various methods of culture which have been persistently recommended by this Bureau, such as systematic planting, the use of cultivators, the interplanting of leguminous cover crops, and the renewal of old plantations, will all be tried in a thorough manner at the demonstration stations which the demonstration and extension division of this Bureau proposes to establish in the principal abacá provinces during the coming fiscal year. It is believed that these demonstrations will convince many planters of the advantages of employing such methods and will finally lead to a general substitution of these for the wasteful, inadequate, and ruinous methods now in general use.

Quality of the fiber.—The average quality of abacá throughout the Archipelago remains low and far from satisfactory. It is difficult to estimate the production of abacá by grades, as droughts, typhoons, market conditions, and the established custom of the producers in certain provinces or in certain localities in the same province, all tend to cause variation in the quality of the fiber turned out. It is roughly estimated that during the last year the Albay crop averaged between good and superior seconds; the Camarines crop, fair or good seconds; the Sorsogon crop, about 25 per cent over current or midway; the Leyte crop, current U. S.; the Samar crop, midway, or 75 per cent over current; the northern Mindanao crop, about current or 25 per cent over; and the southeastern Mindanao crop, good current or 50 per cent over.

The exports of abacá are not tabulated according to grades and, therefore, the exact figures showing the proportion of the exports of each grade to the total are not available. From figures obtained from some of the principal exporting houses in Manila, however, it has been possible to give an approximate estimate, which it is believed cannot be far from correct. These figures show that the exports by grades during the calendar year 1912 were as follows:

	Per cent.
Best and good grades, from 50 to 300 per cent over good current	10
Good current grades, from 75 per cent over current to 25 per cent over good current	18
Current grades, from current to midway	40
Low grades, from fair brown (red) to superior seconds	32
Total	100

The tests made at various times by the fiber division have demonstrated that the fiber carefully extracted and properly handled prior to and after extraction averaged approximately as follows:

	Per cent.
Best and good grades, from 50 to 300 per cent over good current	60
Good current grades, from 75 per cent over current to 25 per cent over good current	25
Current grades, from current to midway	10
Low grades, from fair brown (red) to superior seconds	5
Total	100

A comparison of the above tables clearly indicates the extent to which the quality of the fiber may be improved by the practice of a more judicious method of extraction and by careful handling. It must be admitted, however, that for several reasons such progress is difficult of accomplishment, though a considerable advance can, and should, be made.

Effect of 1912 drought and typhoons on production and value of abacá.—A year ago the Philippine Islands were emerging from the ravages of a prolonged and unusually severe drought. In the fall of 1912 two severe typhoons occurred, which caused considerable damage to abacá, principally in the Province of Leyte. Early in May, 1913, another typhoon occurred which passed through Albay, southern Samar, Leyte, Mindoro, and the Ilocos Provinces, all of which with the exception of the last two are important producers of abacá.

From estimates made by the chief of the fiber division, based on personal field investigation, it would appear that a shortage of 30 to 35 per cent in the total production for the Islands can be reasonably expected to occur, taking effect during January, 1913, and extending to May or June, 1914. This estimate, however, may possibly be reduced, owing to the fact that a large number of plantations which had been almost utterly neglected before the recent considerable rise in the price of abacá have again been brought under cultivation.

Summing up the whole situation as it now stands, and taking into consideration every factor which tends to accelerate or counteract the effects of the drought and typhoons of 1912, it is believed that the production of abacá may be safely estimated at 145,000 metric tons for the fiscal year 1913, or about 10 per cent less than 1912; and at not less than 105,000 to 110,000 metric tons for the fiscal year 1914, or about 35 to 30 per cent less than 1912. The quantity available for export is usually five to ten thousand metric tons less than the actual production.

The exports during the fiscal year 1912 were 154,046,928 kilos (154,047 metric tons) valued at ₱32,567,020, or an average value of ₱21.20 per 100 kilos. The exports for this fiscal year are estimated at about 140 million kilos (140,000 metric tons), valued at about 45 million pesos, or an average value of ₱32 per 100 kilos. The rise in value began in July, 1912, and reached its maximum in January, 1913, when good current sold in the Manila market at ₱53.50 per 100 kilos. Since January, however, the price has gradually declined and at the present time the daily quotations give good current at about ₱40 per 100 kilos.

Abacá machines.—The machines mentioned in previous reports have not come into general use. This failure is due, in most cases, to their low capacity, complexity of construction, and to the high cost of operation. An abacá-cleaning machine, which appears to be very promising, has recently been brought to Manila from the United States. No official tests of this machine have yet been made.

Knotted abacá.—This industry has continued to develop, and it now forms one of the chief home industries in Cavite, Batangas, Iloilo, and other provinces. The exports of abacá of the finest grades to Japan and Europe where the fiber is knotted and manufactured into hat braids and other textile articles have also continued and have probably increased over last year.

AGAVE AND ALLIED FIBERS.

Maguey (cantala) and sisal.—There has been no change in the status of this industry during the year. Both maguey and the true sisal continue to be planted in small and scattered areas principally as an emergency crop. The present condition of the plantations does not permit the use of machinery for extracting the fiber, and the "retting" method is still practically exclusively used.

Distribution of suckers and bulbils.—Owing to the rise in the price of maguey during the year, there has been more demand for suckers and bulbils than during the last three or four years. About 30,000 bubils and 10,000 suckers of sisal and 10,000 suckers of maguey have been distributed during the year. Requests from provinces where plantations of maguey or sisal are found were not filled, but referred to the localities where plants can be obtained.

Production and value.—The demand for maguey and sisal during the year has been brisker than for several years before. This was due to the expected shortage in the production of abacá, on the one hand, and to a strong demand in the United States for binder twine, on the other. The Philippines reaped their share in the rise in the prices of the so-called sisal fibers, which fact is shown by the substantial increase in the quantity and value of maguey exported during the year. During the fiscal year 1912, 4,593,226 kilos (4,593 metric tons) of maguey, valued at ₱641,942, or an average of ₱14 per 100 kilos, were exported from the Philippines. During this year the customs figures give the exports at 8,335,823 kilos (8,336 metric tons), valued at ₱1,408,788, or an average of about ₱17 per 100 kilos.

Enemies and diseases.—No new enemies nor diseases of the maguey and sisal plants have been discovered during the year. The fungus disease discovered last year on sisal leaves at the Lamao experiment station has been identified by the mycologist of the Bureau of Science as *Diplodia agaves* Niessel. The spores of this fungus arrange themselves in oval concentric bodies. This disease does not appear to spread easily and there does not seem to be any difficulty in checking it, which can be done by cutting the leaves as soon as its appearance is detected.

Agave and Furcroea introduction.—It has been desired to make a thorough study of all the commercial species of Agaves and Furcroeas for the purpose of ascertaining the relative merits of their fibers and other matters connected with their habits of growth and cultivation, and at the beginning of this year this work was commenced.

To carry on this work a section of land at the La Carlota experiment station was set aside and divided into as many plats as there are commercial species in the two genera in question. The following plats, which consist of 4 rows 30 meters deep each, were planted during the year: Maguey (*A. cantala*), sisal (*A. sisalana*), henequen (*A. fourcroydes*), zapupe (*A. zapupe*). an agave species not yet determined, and Mauritius hemp (*F. foetida*). The henquen and Mauritius hemp bulbils were obtained from Porto Rico. The zapupe suckers were obtained from plants grown here and introduced from Mexico in 1905. An attempt will be made this year to obtain bulbils of the remaining commercial species of the two genera.

KAPOK.

Status of the industry.—A decided impetus has recently been given the kapok industry, which is manifested by the establishment of several plantations in central Luzon. Without the establishment of such plantations where modern methods can be used for cleaning and baling the floss, it would be impossible for the industry to develop to the extent warranted by the admirable quality of the floss and its utility in several important manufactures. The demand for Philippne kapok has recently considerably increased, but the local facilities for its preparation and transportation are inadequate to meet the requirements of the industry. The progress of the industry will necessarily be slow until the plantations shall have attained the producing stage.

COTTON.

In October, 1912, the fiber division started experimental work in the growing of cotton at the La Carlota experiment station. During the fiscal year 1912 a preliminary investigation had been made for the determination of the native species of cotton grown throughout the Islands, the results of which were given in the last annual report. Seeds of these species were obtained for planting during this year. Early in 1912 seed of thirteen types of cotton, mostly American upland, were obtained from the United States Department of Agriculture. These, with seed of three varieties of Caravonica cotton which had been previously obtained by this Bureau, were planted at La Carlota about the middle of October. Shortly after the seed was planted a typhoon washed off part of the soil and carried away or mixed the seed. The second planting toward the end of October was made, which was again considerably hampered by heavy rains which accompanied the November typhoon. The following is the summary of the results obtained from the year's work.

American upland cotton.—Of these types of cotton the following were planted in separate plats in the following order: Hartsville, Shankhigh, Trice, Triumph, Lone Star, Saunder's 3, Lanquin, Acala, Durango, Columbia, Foster, Allen, and Egyptian. This seed was received shortly after the planting season of 1911, and was consequently somewhat old when planted this year. It was probably for this reason that the Triumph, Saunder's 3, and Egyptian failed to germinate. The other types germinated fairly well, though the succession of floods considerably reduced the stand.

All the types which germinated made a very fair growth and blossoms commenced to appear during the month of January. The cotton bolls reached maturity during April and May. During the early development of the bolls, they were profuse and very fair crops would have been obtained had it not been for the ravages of weevils and other insect pests. The weevil trouble assumed such a serious stage that a boll rarely reached the picking stage in a perfect condition. The crop therefore was a total failure, and nothing was obtained except very few bolls for specimens and for seed.

Toward the end of February the foliage of all these types was attacked by a rust which soon after spread so as to include the leaves of almost every plant. Specimens of these infected leaves were secured and the disease was later identified by the mycologist of the Bureau of Science as in all probability *Uredo gossypii* Lagerh.

Native species.—The following native species of cotton were set out in plats at the same time as the American upland types: Toguillo (kidney-cotton), Gapaz Kinachila, Taal, and Gapas Sanglay, or Candava (brown cotton). Of these the Taal seed failed to germinate, while the rest made a splendid germination.

The three species which germinated made a very luxuriant growth, much superior to the American types. The blossoms appeared a few weeks later than the latter, and the bolls did not mature until a month, and in the case of Toguillo and Kinachila six weeks, later than the American types. In point of yield the Toguillo and Kinachila, especially the latter, were much inferior to the American cottons, though the Sanglay compared very favorably with the latter. These native species were not seriously injured by the weevil which wrought so much damage to the American cotton. The rust disease also was totally absent except in some instances on leaves of the Sanglay.

Caravonica cottons.—The seed of the three varieties of Caravonica, namely, silk, wool, and alpacá, failed to germinate. An attempt will be made to obtain fresh seed for planting in connection with the next year's experiments.

Conclusions.—The general conclusions to be deduced from this year's experiments are the following:

1. The cultivation of American and other foreign species on a large scale from imported seed, at least in the vicinity of La Carlota, is an unsafe investment. This can probably be accomplished only after the seed has been selected from plants which have been thoroughly acclimated to local conditions, or after it has been improved by crossing with one of the native species.
2. Of the native species, the Toguillo and the Taal are the only two that can be recommended for cultivation on a large scale. Careful selection of seed will undoubtedly increase their yield.
3. The successful cultivation of cotton in the Philippines depends to a large extent on the proper time for planting. This varies somewhat with the different species, but the rule is the same, e. g., the seed should be planted so as to bring the plants to maturity not later than the middle of the dry season. After that period, heavy rains are liable to set in with such frequency as to impair the quality of the floss.

During the next year a more extensive line of experiments will be undertaken, and a cotton specialist is expected to arrive in time to take charge of this work. The same species and types will be planted again, together with new ones. Selection and breeding work will also be attempted with the view of improving the types already cultivated or originating new types which will, on the one hand, meet the requirements of the industry and, on the other, will also be adapted to local conditions.

MISCELLANEOUS FIBERS.

The object of the investigations with miscellaneous fibers is twofold: First, to introduce from foreign tropical and semitropical countries fiber plants of commercial value; and second, to grow fiber plants, either native or introduced, the fiber of which has good prospects of becoming a commercial article. Of the large list of such fiber plants the following were tried during the year:

China grass (*Boehmeria nivea*).—A plat in the section of land set aside for miscellaneous fiber plants at La Carlota was planted from seed originally obtained from London, England. The first trial was made at the Singalong experiment station but owing to excess of moisture the plants did not do well. Although this species is not ordinarily grown commercially in tropical countries, it was thought advisable to give it a trial here. The tropical variety, the *tenacissima* (ramie or rhea) will be planted in an adjoining plat during the next year.

Roselle (*Hibiscus sabdariffa*).—Two tall varieties of roselle, the white and the red, have also been planted during the latter part of the year, but it is yet too early to give any statement as to their prospects. The seed was introduced from India.

Hibiscus cannabinus.—A very few plants of this species were grown at the Singalong and Lamao experiment stations. The plants made excellent growth, but the manner in which they were planted was not such as would produce the best results for fiber purposes.

Carludovica palmata.—Two plants of this species which had been grown at the Lamao experiment station from seed originally introduced from Panama were divided and about 30 shoots were set out. As soon as these are well established, they will be transplanted to La Carlota. Request for a sufficient quantity of seed has also been made, which will be planted in time for future distribution. The plant appears to grow luxuriantly in the Philippines, and with the skill of the Filipinos in the art of hat making, it is hoped that the Panama-hat industry may be successfully established here.

Anabú (*Abroma augusta*).—The best fiber produced by this native species has been reported to be suitable for most of the uses for which the India and Tientsin jutes are used. Seeds from a wild plant found at Lamao were planted during the year, and the seedlings are now about 12 to 15 centimeters high.

Sansevierias.—Plats have been prepared during the year for planting the following species of this genus: *S. zeylanica, S. guineensis, S. cylindrica,* and *S. sulcata.* The first species is grown extensively in the Islands as an ornamental plant. A few plants of the remaining species were introduced two years ago from the Singapore botanical garden and an attempt has been made to propagate them. It is believed, however, that only the first two species may prove to be of commercial importance.

Ticog (*Fimbristylis utilis*).—Through the courtesy of the Bureau of Education seed of this sedge was obtained and planted in a fresh-water swamp at La Carlota. This seed failed to germinate. In November divisions of the root from the same species grown in the neighborhood of La Carlota were obtained and planted in an adjoining plat in the same swamp, and these have all grown luxuriantly. This method of propagation appears to be much more certain than propagation from seed.

DEMONSTRATION AND EXTENSION DIVISION.

The demonstration projects established during the fiscal year, 1912, in Cebu, Bohol, Iloilo, Capiz, Batangas, and the Mountain Province have made satisfactory progress during the past year. New projects have been started in Surigao, Rizal, Cavite, Laguna, and Bulacan.

On February 7, 1913, Act No. 2226, "An Act to establish stations for practical instruction in matters concerning agriculture and a system of agricultural demonstration and development," was enacted by the Third Philippine Legislature. This act provides for an annual expenditure of one hundred and fifty thousand pesos for coöperative demonstration work and assures the establishment of this work on a permanent and substantial basis.

The two main features of the demonstration work are the demonstration stations and the coöperative demonstration plots. The stations serve as a headquarters for the demonstration work in each district or province, while the demonstration plots make it possible to carry the work into each municipality. The stations that have thus far been established are receiving the cordial support of the people and more demonstration plots have been offered than there were inspectors to supervise. It has been fully shown that there is a strong demand for practical work of this character and it has been demonstrated that this work produces results more than commensurate with the expenditure required.

ILOILO-CAPIZ DEMONSTRATION PROJECT.

The demonstration and extension work in Iloilo and Capiz was organized as a project on July 1, 1912. During the following month the Iloilo quarantine station of the Bureau of Agriculture was transferred to the demonstration division to be used as a demonstration station. This station is two kilometers from the city of Iloilo and is situated in a bend of the Jaro River. It contains 76,000 square meters of low and very fertile "gumbo" soil. The entire station has been fenced and a large part of it has been plotted and planted. Twenty cavans of selected Moro seed maize and forty cavans of maize for feeding the animals at the station have been harvested. At the close of the year fourteen demonstration plots at this station were planted to the following crops: Cowpeas, Virginia dent, and Moro maize, Hawaiian papayas, castor beans, American sweet potatoes, Sanford's white flint maize, New Era cowpeas, Mexican June maize, peanuts, rape, pineapples, and sugar cane. There are also three large fields planted in Moro maize and one large field in guinea grass and sorghum.

The Iloilo demonstration station is now in splendid condition and will produce a sufficient quantity of good seed for distribution throughout the two provinces. The work that is being carried on is attracting a great deal of attention and the station is visited by a large number of farmers and other persons interested in agricultural progress.

From May to December, 1912, 14 maize demonstration plots were planted and harvested in the Provinces of Iloilo and Capiz. During December, 1912, and January, 1913, 25 maize plots in Iloilo and 25 in Capiz were planted. These plots were harvested and a third series planted in May and June, 1913. It will be noted that during the past year three crops of maize have been grown on the Iloilo and Capiz demonstration plots.

When it is considered that the average production of maize per hectare for the Philippine Islands is 8.22 cavans, that maize planted the native way on river-bottom land in Panay gives an average yield of only 26 cavans and 23 gantas per hectare, and that maize from selected and tested seed planted on this same river-bottom land and cultivated under the demonstration methods produced 95 cavans and 16 gantas per hectare, it is evident that this work is badly needed and that it produces results. The highest and lowest yields from the 14 plots harvested during September and October, 1912, were 98 cavans and 31 cavans, respectively, per hectare. On all of these plots the yield was from 25 to 150 per cent more than that produced on similar land in the same locality where the native methods were used.

It is stated by officials of the Philippine Railway Company that, as a result of the demonstration work carried on by the Bureau of Agriculture in Panay, more shelled maize was shipped into Iloilo from Capiz and way points during the months of

August, September, and October, 1912, than had been shipped in the past three years. Farmers are now growing maize in the Provinces of Iloilo and Capiz who never thought of planting it before the demonstration work was established.

CEBU DEMONSTRATION PROJECT.

During the earlier part of the fiscal year, 1913, the Province of Cebu was infested with numerous swarms of locusts which destroyed the crops on many of the demonstration plots that had been established in this province. During October and November Cebu was visited by two extremely severe typhoons which devastated large sections of the island and did still further damage to the crops that were being grown for demonstration. Of 28 plots that had been planted during the latter part of the fiscal year 1912, 17 were entirely destroyed. The 11 plots that were harvested, however, gave an average yield of 59.1 cavans of maize per hectare, which was 81 per cent higher than the yields on adjoining lands cultivated by native methods.

It would be difficult to conceive of conditions more unfavorable than those under which the demonstration work in Cebu was carried on during the calendar year 1912. Within a period of twelve months the province was visited by most severe droughts, locust infestations and two destructive typhoons. The fact that under these conditions definite and positive results were obtained is highly encouraging.

During the second half of the fiscal year 1913 12 maize plots, 3 tobacco plots and several other miscellaneous plots have been under cultivation in Cebu.

In connection with the demonstration work, the inspector in charge of this project has carried on lecture work in different municipalities, has distributed a large quantity of seeds and plants and has furnished valuable assistance in the locust campaign.

BATANGAS DEMONSTRATION PROJECT.

In October, 1912, the Batangas breeding and demonstration station was established. This station furnishes an excellent example of the coöperative spirit that is now being shown in different provinces in the work of promoting agricultural improvement. The municipality of Batangas furnished a tract of land for the station and the province fenced this land, constructed the necessary buildings, and has supplied a part of the labor required for the operation of the station. The Bureau of Agriculture has furnished the superintendent and other employees, breeding animals and equipment. As a result of this coöperation the people of the province and the municipality are keenly interested in the work that is being done.

The major part of the work at this station has been the breeding work, which is covered by the report of the division of animal husbandry. Of the crops planted Moro and Iloilo maize have given fairly satisfactory results. Rhodes grass has done well and considerable seed has been saved. Guinea grass, sorghum, and cowpeas have all made a fairly satisfactory growth.

Arrangements have been made for planting demonstration plots in every municipality in the province after the opening of the rainy season. Forty plots have been selected, which are distributed among different crops as follows: Maize, 31 plots; rice, 3 plots; orange-tree pruning, 3 plots; and sugar cane, 3 plots.

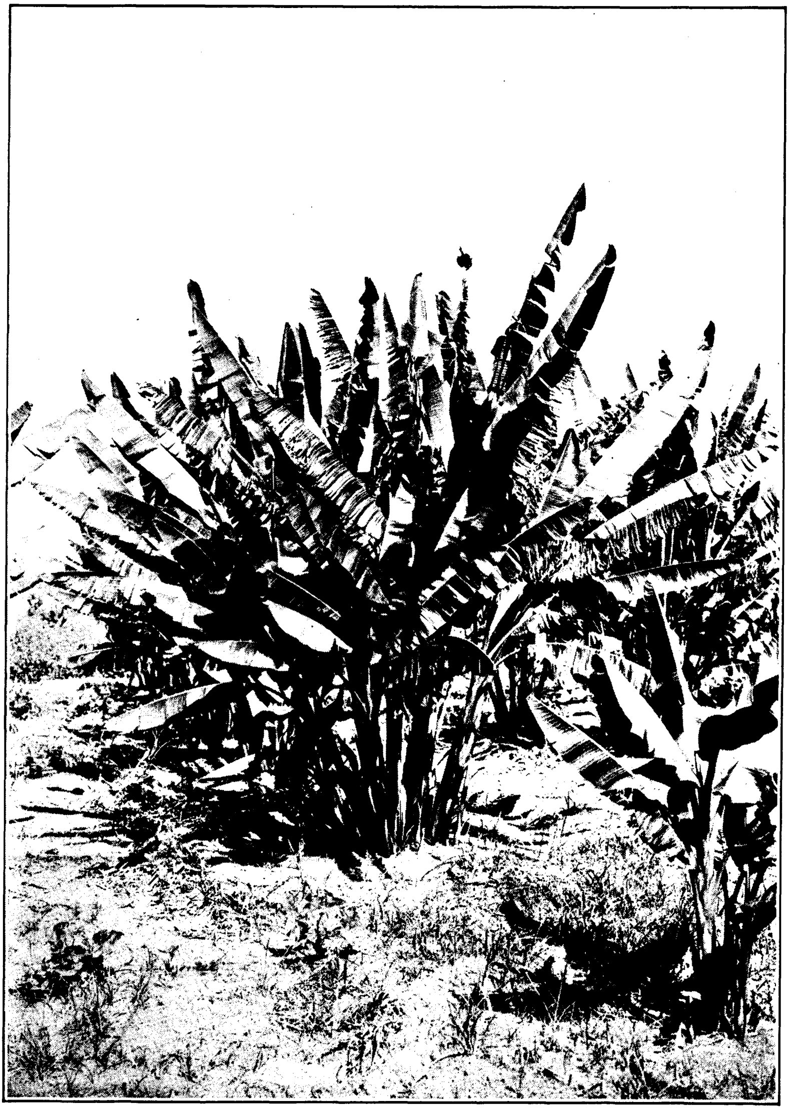
MOUNTAIN PROVINCE DEMONSTRATION PROJECT.

The territory covered by this project includes the seven subprovinces of the Mountain Province and the Province of Nueva Vizcaya. These two provinces include not only a very large area, but also widely varying conditions ranging from those of the tropical lowlands found in the coast regions of Amburayan and Apayao to the approximate temperate-zone conditions found in the higher altitudes of the Mountain Province. Under these circumstances very careful judgement must be exercised in the methods used and in the distribution and planting of seed over this large area in order that the work done may be entirely suited to the local conditions of each particular district.

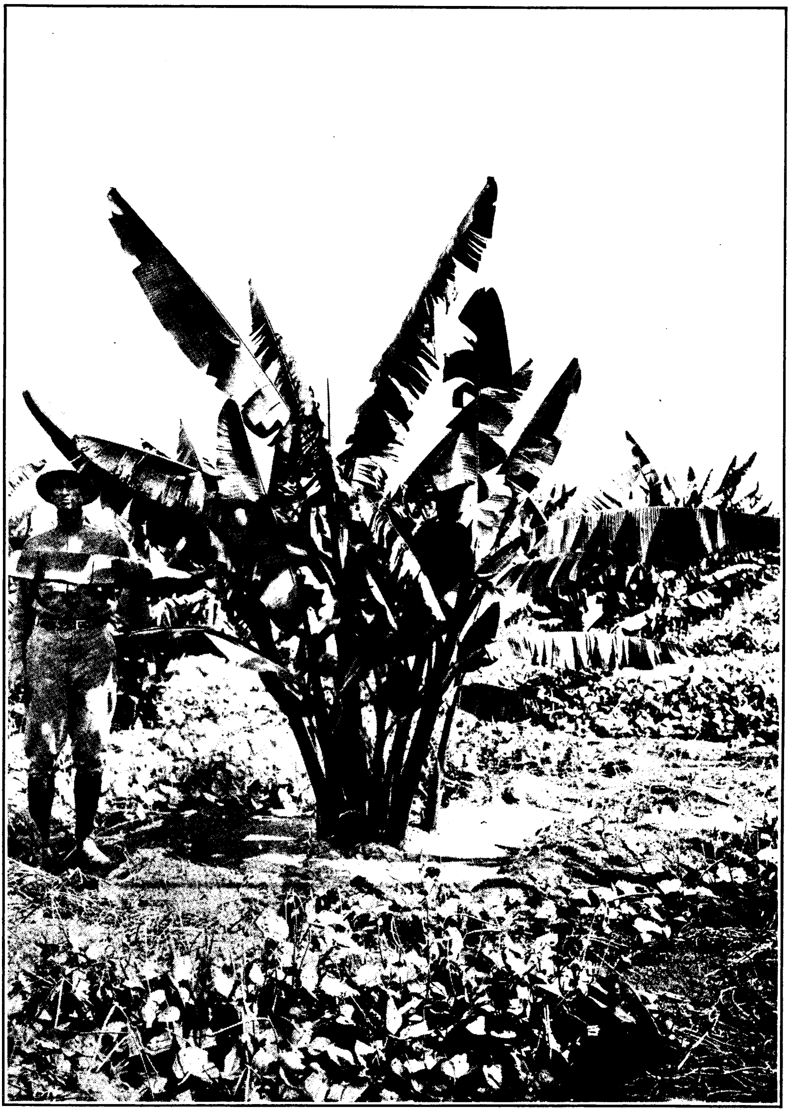
This project is supervised by an agricultural inspector with six assistant agricultural inspectors detailed in the different subprovinces. The most important feature of the work carried on under this project up to the present time has been the establishment of demonstration gardens at a number of selected points and a very wide-spread distribution of seeds and plants.

In the subprovince of Benguet the Trinidad garden is the headquarters for the demonstration work. Seeds and plants are grown at this garden and are distributed throughout the subprovinces by an assistant inspector. The very excellent gardens to be found throughout the municipality of Trinidad are one of the direct results of the work that has been accomplished in this section.

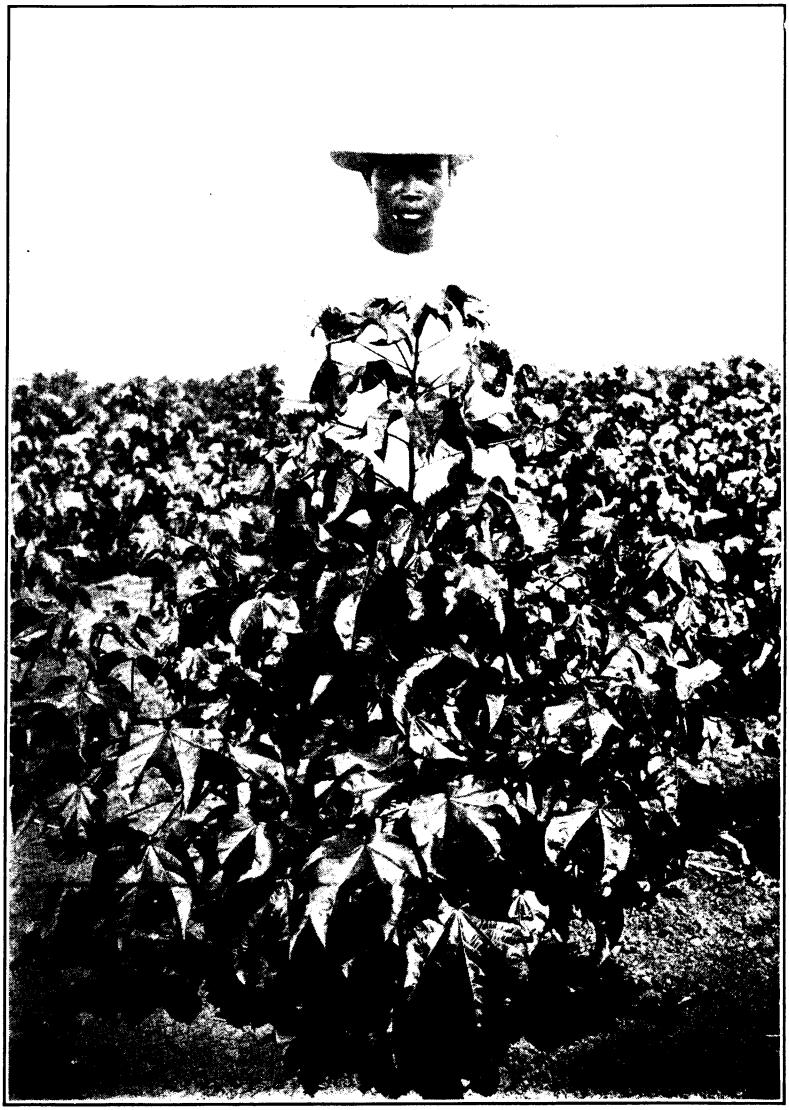
In the subprovince of Bontoc the demonstration work has been greatly aided by the local officials, who have placed the large jail garden under the supervision of the inspector of the



Abacá plant, 15 months old, "Bangulanon" variety of southeastern Mindanao, reproduced from rootstock. La Carlota experiment station, Occidental Negros.



Abacá plant, "Laguis" variety of northeastern Leyte, 11 months old, reproduced from rootstock. La Carlota experiment station, Occidental Negros.



Kidney cotton plant (native "Toguillo"), 5 months old. La Carlota experiment station, Occidental Negros.

Maize plot at the Santa Cruz demonstration station.

Endive and onion plots at the Santa Cruz demonstration station.

Bureau of Agriculture. This garden has been used as the headquarters for the demonstration work in this subprovince.

Other points in the Mountain Province at which demonstration work has been established are Natonin, Sagada, Lubuagan, Tagudin, and Quingan. During the latter part of the year an assistant inspector was detailed to carry on the demonstration work in the Province of Nueva Vizcaya.

RIZAL-LAGUNA-CAVITE DEMONSTRATION PROJECT.

The agricultural situation in the district which includes the provinces adjoining the city of Manila is somewhat different from that found in any other part of the Islands. This district has excellent transportation facilities and also access to the markets of the city of Manila. There is opportunity in the Provinces of Rizal, Laguna, and Cavite to carry on not only the ordinary lines of demonstration work, but also special work with market garden crops.

During the latter part of the year a demonstration project was established which includes these three provinces. A small coöperative demonstration station has been opened at Santa Cruz, Laguna, the land and fencing for this station having been furnished by the province.

At the close of the year 13 demonstration plots had been secured and planted in the Province of Rizal, 9 plots in the Province of Cavite, and 3 plots in the Province of Laguna.

AGRICULTURAL DEMONSTRATION CAR.

During the latter part of the year the Manila Railroad Company, at the request of the Bureau of Agriculture, offered to construct an agricultural demonstration car to be used along the railway lines on the Island of Luzon. This car is 14 meters long and 3 meters wide. The interior construction provides for exhibits of different crops, farm implements, photographs, charts, maps, etc., and has also sections that will be used in the distribution of seeds and publications. In connection with the other work of the demonstration car illustrated lectures will be given at the different places visited. At the close of the year this car had been completed and the exhibits were being installed.

DISTRIBUTION OF PUBLICATIONS.

All the publications of the Bureau of Agriculture other than the regular mailing list of the Philippine Agricultural Review, are distributed by the demonstration and extension division. The following statement shows the total number of publications distributed during the past year:

Bureau of Agricultural publications distributed during the fiscal year ending June 30, 1913.

	English.	Spanish.	Tagalog.	Cebuano.	Ilocano.	Ilongo.
Bulletins	6,909	1,131			5	
Circulars	3,617	3,571	234	707	24	50
Roselle circulars	407	455				
Kapok circulars		63	1			
Press bulletins	12	9				
Sugar handbooks	161	348				
Philippine Agricultural Review	3,529	1,071				
Reprints	202	7				
Sugar bulletins	429					
Indexes to Philippine Agricultural Review	80					
Total	15,345	6,655	235	707	29	50

DIVISION OF PUBLICATIONS.

The work of the division of publications covers the following: The publication and distribution of the Philippine Agricultural Review; the publication of bulletins, circulars, etc.; supervision of the Bureau of Agriculture library; miscellaneous printing on the planotype; and translations.

THE PHILIPPINE AGRICULTURAL REVIEW.

Previous to July 1, 1912, the Review had been distributed free of charge throughout the Philippine Islands, and in the United States and foreign countries as well, with the exception of a few paid foreign subscriptions. During the fiscal year 1912 an average of 3,350 English and 3,762 Spanish copies had been issued each month. Owing to the cost of this publication, the large mailing list, the lack of information in regard to the status of many people on this list, and the large number of requests for the Review received from persons whose status was not known, it was considered advisable to continue the free distribution to various Government officials, commercial firms, libraries, etc., and require all others to pay a subscription price, in the Philippine Islands and the United States of ₱2 and in foreign countries of ₱4. This policy has considerably reduced the mailing list, but has resulted in marked economy and a much more effective distribution of the Review.

During the fiscal year 1913 an average of 1,705 English copies and 1,438 Spanish copies were sent out.

The number of paid subscribers was much smaller than was expected, there being 172 subscribers to the English and 193 to the Spanish edition.

Two hundred and five English and 78 Spanish copies were sent out monthly in exchange for foreign and local periodicals.

Three hundred twenty-two English copies of each issue were delivered to the Bureau of Education for distribution to school libraries throughout the Philippine Islands.

One thousand two hundred and twenty-four English and 1,167 Spanish copies were forwarded each month to Government officials and other persons on the free mailing list.

Owing to the large amount of material available covering special subjects, the general policy of devoting every other number to one single subject was instituted during the fiscal year. The following special numbers were issued: (1) Economic Horticulture, (2) Ornamental Horticulture, (3) Veterinary Number, (4) Annual Report 1912–13, (5) Fiber Number, (6) Demonstration and Extension Number.

During the fiscal year the monthly distribution of the English edition of the Review was as follows: Philippine Islands, 1,108; United States, 424; foreign countries, 391. The monthly distribution of the Spanish edition of the Review was as follows: Philippine Islands, 1,364; United States, 4; foreign countries, 70.

BULLETINS AND CIRCULARS.

Bulletins and circulars prepared in the various divisions of the Bureau are forwarded to the division of publications for editing. All expenses entailed in the publication of a bulletin or a circular are borne by the division from which it emanates.

The following bulletins and circulars, including reprints from the Review, have been issued during the fiscal year:

Bulletins, circulars, and reprints published during fiscal year 1912–13.

Subject.	Author.	Copies.	
		English.	Spanish.
BULLETINS.			
No. 22. Rice Culture in the Philippines	C. M. Conner	2,000	
No. 23. Corn Culture in the Philippine Islands	Sam H. Sherard	1,500	1,000
No. 24. The Role of *Stomoxys calcitrans* in the Transmission of *Trypanosoma evansi*.	M. B. Mitzmain	1,000	
No. 25. The Philippine Coconut Industry	O. W. Barrett	5,000	
No. 26. The Kapok Industry	M. M. Saleeby	2,000	
CIRCULARS.			
No. 16. Pineapple Culture	P. J. Wester	1,000	1,000
No. 17. Corn Culture	Sam H. Sherard	1,000	1,000
No. 18. Rice Culture	C. M. Conner	1,500	3,000
No. 19. Maize Pests	C. R. Jones	1,000	1,000
No. 20. The Mango Bark Borer	do	1,000	1,000
No. 21. Kapok Culture	M. M. Saleeby	2,000	2,000
No. 22. Maguey (Cantala) and Sisal Culture	do	2,000	2,000
REPRINTS.			
Data Concerning Varieties of Rice	C. M. Conner	500	
The Situation in the Citrus District in Batangas	P. J. Wester		300
Collected Notes on the Insect Transmission of Surra in Carabao.	M. B. Mitzmain	100	

PLANOTYPE.

Such printed matter as tabulations, cards, special orders, etc. of less than two pages in length of which not more than 2,000 copies are printed, and matter of a confidential nature or which is desired earlier than a delivery could be made by the Bureau of Printing, is turned out on the planotype. Printed matter not coming under this classification is forwarded to the Bureau of Printing.

During the fiscal year delivery was made on the following work orders: Manuscript, 111 orders; tabulations, 87 orders; cards, etc., 75 orders. This makes a total of 273 work orders and 253,715 copies printed.

LIBRARY.

In order to put the library work on a systematic basis, it has been entirely reorganized during the past year. The library was first classified and rearranged on the shelves and the catalogue begun. The Library of Congress scheme of classification was adopted, as this is the system used by the other government libraries.

A combined author and subject card catalogue is being made. It now consists of approximately 5,500 cards. In addition to the current material, all the bound volumes and single publications available, and a large number of serial publications, have been catalogued. About 119 new books have been received during the year.

The library is at present receiving about 230 periodicals, 22 of which are new subscriptions. This number does not include newspapers received as exchanges or otherwise. All periodicals previous to the current year have been removed from the periodical shelves, recorded on serial card, and missing numbers sent for.

A new circulation scheme is being installed which consists of a book card on which will be kept a permanent record of the persons to whom the book has been issued, and a borrower's card on which are recorded all books issued.

DIVISION OF STATISTICS.

The character of the statistical reports has very materially improved during the past twelve months. These reports are rendered more regularly and promptly and the data furnished have been more reliable than heretofore. The use of circular letters to all municipal presidents outlining the use of the blank forms has probably been more instrumental than anything else in improving the quality of these reports. The "apparent errors" sheets have also helped a great deal.

The labor of auditing and tabulating the figures which appear on the crop reports and on the animal lists has, for the past year, been the same as stated in last year's annual report from this division. It has been the effort of this division to be sure that data were reasonable and in accord with the facts before releasing them for publication. This has required careful checking and frequent return of reports to municipal presidents for correction. The work of the division seems to be appreciated more highly than in previous years and officials of other Bureaus frequently call for our statements in minute detail. As in previous years Bureau of Agriculture statistics are in great demand by foreign consuls, merchants representing foreign firms, and by students in schools and colleges where agricultural research is being pursued.

DIVISION OF MACHINERY AND CONSTRUCTION.

The operations of this division include the Pandacan forage factory, the Pandacan repair shop, steam and motor plowing, and the supervision of all work pertaining to the purchase, construction or installation of machinery and buildings of the Bureau.

PANDACAN FORAGE FACTORY.

The work of this factory is to manufacture crushed and mixed feeds, consisting principally of Philippine maize, together with a smaller amount of imported bran and beans. The main object for which the factory was established was to develop the use of local forage products.

During the past year 641 tons of maize were purchased at an average price of ₱40 per ton on the cob. Ninety-two tons of bran at an average price of ₱70, and 90 tons of beans at an average price of ₱100 were also purchased. The maize was bought at a time of the year when it was wet and heavy and a part of it molded, causing considerable loss. Later on, as it dried, it became infested with weevils which was another source of loss. Fumigating bins were constructed but the transferring of the grain to and from same was attended with considerable loss. At the end of the fiscal year there remained in stock about one hundred tons of maize.

The bran has been kept in fair condition having been only slightly attacked by the weevils. That remaining at the end of the fiscal year, about 40 tons, is still in good condition. The beans are in good condition and about 65 tons remain at the end of the fiscal year.

PANDACAN REPAIR SHOP.

The work of the repair shop includes the repair of all bureau property, and the construction of such articles as can be economically made at this shop.

A number of skilled and semiskilled workmen, and also laborers, are employed to carry on the work under the supervision of the superintendent. One hundred and forty-seven motorcycles and 137 bicycles came into the shop during the year for repairs. Besides this, parts of motorcycles, bicycles, etc., were shipped to the provinces and there placed on broken machines. One hundred and one work orders were received and accomplished consisting of various kinds of office furniture and other miscellaneous articles made and repaired.

STEAM AND MOTOR PLOWING.

It was proposed to conduct further experiments with steam and motor plows to determine, if possible, a more economical means of preparing the land for rice and sugar. In order to carry out these experiments, a plow of heavy construction was designed and constructed according to plans and specifications prepared by the chief of the division of machinery and construction. This plow has not yet been used, as it was received subsequent to the resignation of the chief of this division, and no employee has been available to supervise this work.

H. T. EDWARDS,
Acting Director of Agriculture.

The SECRETARY OF PUBLIC INSTRUCTION,
Manila, P. I.

GENERAL AND STATISTICAL TABLES.

No. 1.—*List of directing and superintending officers.*

[July 1, 1913.]

Frederic W. Taylor, *Director of Agriculture.*
H. T. Edwards, *Assistant to the Director.*

DIVISIONS.

Divisions.	Chief of division.
Clerical	W. E. Cobey.
Finances and property	T. R. Flack.
Animal husbandry	C. W. Edwards.
Veterinary	A. R. Ward.
Agronomy	C. M. Conner.
Horticulture	O. W. Barrett.
Fiber	M. M. Saleeby.
Demonstration and extension	H. T. Edwards.
Publications	S. Stickney.
Statistics	B. P. Lukens.
Machinery and construction	(Vacant).

EXPERIMENT STATIONS AND STOCK FARMS.

Station or farm.	Superintendent.
Alabang stock farm	H. F. Hungerford.
Trinidad stock farm	A. L. Bradley (acting).
La Carlota experiment station	H. J. Gallagher.
Lamao experiment station	F. C. Kingman.
Singalong experiment station	H. R. Reed (acting).

DEMONSTRATION AND BREEDING STATIONS.

Station.	Province.	Superintendent.
Iloilo	Iloilo	Sam. H. Sherard.
Virac	Albay	E. H. Koert.
Batangas	Batangas	H. T. Nielsen.
Ilagan	Isabela	O. S. Soriano, in charge.
Trinidad Garden	Mountain	Austin M. Burton.
Santa Cruz	Laguna	Peter Braun.

No. 2.—*Inspections at the port of Manila for the fiscal year ended June 30, 1913.*

Port of embarcation.	Number on arrival.		Shipped to provinces.		Deaths.	
	Cattle.	Carabaos.	Cattle.	Carabaos.	Cattle.	Carabaos.
Philippine	4,833	1,171	3,337	1,136	40	43
Pnom Penh (Indo-China)	898	286	1,388	433	50	27
Formosa			132	5	15	
Australian	68		131		18	
Total	5,799	1,457	4,988	1,574	123	69

No. 3.—*Inspections at port and city of Manila during fiscal year ended June 30, 1913.*

Kind of animals.	Inspected on arrival.				Arrived from—	
	Total.	Without fees.	Rate per head.	Fees collected.	Foreign ports.	Philippine ports.
Cattle	5,799	17	₱0.20	₱1,156.40	966	4,833
Carabaos	1,457	1	.40	582.40	286	1,171
Horses	1,789	465	1.00	1,324.00	416	1,373
Hogs	63,812	35	.10	6,377.70	21	63,791
Sheep	94		.20	18.80		94
Goats	920	4	.20	183.20	3	917
Other animals	111		.40	44.40	30	81
Total	73,982	522		9,686.90	1,722	72,260

Remarks.—Seventeen cattle, 1 carabao, 68 horses, 35 hogs, and 4 goats admitted free on arrival (Civil Government); 397 mules admitted free on arrival (United States Army); 1 carabao died from tetanus; 13 horses killed for glanders; 12 horses died from glanders; 8 horses killed for surra; 18 hogs found dead in owners' corral; 2 hogs found dead in railroad station.

No. 4.—*Live-stock report of inspections port and city of Manila during fiscal year ended June 30, 1913.*

Kind of animals.	Number on arrival.	Shipped.	Slaughtered.	Dead.
Cattle	5,799	4,988	1,631	120
Carabaos	1,457	1,574		83
Horses	1,789	790		205
Hogs	63,812	181	66,616	26
Sheep	94	30	13	0
Goats	920	79	1,455	1
Other animals	111	113	3	1
Total	73,982	7,755	69,718	436

No. 5.—*Post-mortem inspections in Manila abattoir during fiscal year ended June 30, 1913.*

Kind of animals.	Passed for food.	Condemned.	Total.
Cattle	1,612	7	1,619
Calves	12		12
Swine	65,706	910	66,616
Goats	1,455		1,455
Sheep	13		13
Deer	3		3
Total	68,801	917	69,718

No. 6.—*Condemnations in Manila abattoir during fiscal year ended June 30, 1913.*

Causes.	Cattle.		Swine.		Goats.	
	Carcasses.	Parts.	Carcasses.	Parts.	Carcasses.	Parts.
Suspicious rinderpest and dying condition	1					
Lesion suspicious of rinderpest		6				
Comatose condition	4					
Extreme emaciation, enteritis	2		3			
Tuberculosis		9	7	902		
Cysticercus			884	7		
Hog cholera			8	17		
Icterus			6	5		
Septicemia			1			
Pyemia			1			
Found dead	7		12			
Parasitic infestation and cirrhosis		332		1,433		890
Hypostatic congestion		158		11,351		69
Broncho-pneumonia		17		3		4
Inflammation		12		67		
Hypertrophied		2		18		1
Abcesses and contaminations		3		28		
Cysts and sclerosis				182		
Hematoma, bruised, etc		118		29		2
Total	14	657	922	14,042		966

Causes.	Sheep.		Deer.	
	Carcasses.	Parts.	Carcasses.	Parts.
Suspicious rinderpest and dying condition				
Lesion suspicious of rinderpest				
Comatose condition				
Extreme emaciation, enteritis				
Tuberculosis				
Cysticercus				
Hog cholera				
Icterus				
Septicemia				
Pyemia				
Found dead				
Parasitic infestation and cirrhosis		12		2
Hypostatic congestion				
Broncho-pneumonia				
Inflammation				
Hypertrophied				
Abcesses and contaminations				
Cysts and sclerosis				
Hematoma, bruised, etc				
Total		12		2

No. 7.—*Total cases and deaths from various diseases during fiscal year ended June 30, 1913.*

Provinces.	Rinderpest.				Foot-and-mouth disease.				Hemorrhagic septicemia.			
	Cases.		Deaths.		Cases.		Deaths.		Cases.		Deaths.	
	Carabaos.	Cattle.	Carabaos.	Cattle.	Carabaos.	Cattle.	Carabaos.	Cattle.	Carabaos.	Cattle.	Carabaos.	Cattle.
Abra												
Agusan	4											
Ambos Camarines	11	1	16									
Antique	12	2	10									
Bataan												
Batangas												
Benguet												
Bohol	24	6	9	2								
Bulacan												
Cagayan	180		157									
Capiz	30		16		480	14		1				
Cavite	22		18									
Cebu												
Ilocos Norte	200	42	106	32								
Ilocos Sur	24	35	6	12								
Iloilo	43	3	30	2								
Isabela	5		1									
Laguna	15	4	3	4					42		42	
La Union	424	14	177	7								
Leyte	75	25	48	23								
Manila		22		11		576		9				
Misamis												
Mountain	71	3	33	1								
Nueva Ecija												
Nueva Vizcaya												
Occidental Negros												
Oriental Negros												
Pampanga	1,758	27	1,318	17								
Pangasinan	293	21	178	13					14		14	
Rizal	49	6	37	6							56	
Sorsogon												
Surigao												
Tarlac	27	41	20	25								
Tayabas												
Zambales	813	399	254	195								
Total	4,080	651	2,437	350	480	590		10	56		112	

Provinces.	Surra.									Glanders (horses).		
	Cases.			Deaths.			Killed.			Cases.	Deaths.	Killed.
	Carabaos.	Cattle.	Horses.	Carabaos.	Cattle.	Horses.	Carabaos.	Cattle.	Horses.			
Abra												
Agusan												
Ambos Camarines												
Antique												
Bataan												
Batangas												
Benguet												
Bohol												
Bulacan												
Cagayan												
Capiz												
Cavite												
Cebu												
Ilocos Norte			7			6			2			
Ilocos Sur												
Iloilo			14			5						
Isabela			18			12			12			
Laguna												
La Union												
Leyte			23			21			10			
Manila									8		12	13
Misamis												
Mountain			14						14			
Nueva Ecija												1
Nueva Vizcaya			69			18			48	25	12	7
Occidental Negros												
Oriental Negros			5			8			4			
Pampanga												
Pangasinan												
Rizal												
Sorsogon												
Surigao										1	1	
Tarlac			2			1			1	9	7	5
Tayabas												
Zambales												
Total			152			71			99	35	32	26

No. 7.—*Total cases and deaths from various diseases during fiscal year ended June 30, 1913*—Continued.

Provinces.	Lymphangitis (horses).		Other diseases.						Death from diseases unknown.		
	Cases.	Deaths.	Cases.			Deaths.			Carabaos.	Cattle.	Horses.
			Carabaos.	Cattle.	Horses.	Carabaos.	Cattle.	Horses.			
Abra											
Agusan											
Ambos Camarines			21	39		22	9		8	3	
Antique											
Bataan											
Batangas			43	116	27	44	124	34		3	
Benguet											
Bohol					11			3	76	8	10
Bulacan									2		
Cagayan											
Capiz											
Cavite									1	3	4
Cebu						18	34	6	355	65	110
Ilocos Norte											
Ilocos Sur											
Iloilo		1									
Isabela											
Laguna									4		
La Union			5	3		3	3		1		
Leyte			1	2	5	22	7		50	5	30
Manila						36	51	131	26	16	52
Misamis											
Mountain						14					
Nueva Ecija									2		10
Nueva Vizcaya											
Occidental Negros											
Oriental Negros									8	1	5
Pampanga									16		
Pangasinan											
Rizal						8			4		
Sorsogon											
Surigao			115	2		111	2		19		
Tarlac			19			23					
Tayabas									1		
Zambales			37	6	8	133	31	32	42	15	11
Total		1	241	168	51	434	261	206	615	119	232

No. 8.—*Live stock passing through Pandacan quarantine station during fiscal year ended June 30, 1913.*

	Cattle.	Carabaos.
On hand July 1, 1912	207	31
Received during year	876	287
Slaughtered in Pandacan		
Died in station	44	26
Released	1,039	292
On hand June 30, 1913		

No. 9.—*Post-mortem inspections of cattle in Sisiman abattoir and causes of condemnation during fiscal year ended June 30, 1913.*

Causes.	Inspections.	Passed.	Carcasses.	Parts.
Abscesses	9,697	9,646		43
Acute fever			1	
Advance pregnancy			1	
Bruises				117
Congestions				36
Enteritis				1
Fatty degeneration				10
Found dead			20	
Heat stroke			1	
Icterus				17
Inflammations				11
Parasitic nodules				5
Peritonitis			1	
Pleuropneumonia			12	1,092
Tuberculosis			15	2,334
Total	9,697	9,646	51	3,666

No. 10.—*Live-stock purchases for Government branches other than the Bureau of Agriculture.*

Disposition.	Horses.		Cattle.		Swine.		Mules.		Total.		Surcharge.
	Number.	Purchase price.	Number.	Purchase price.	Number.	Purchase price.	Number.	Purchase price.	Number.	Amount.	
Bureau of Constabulary	19	₱4, 905. 00							19	₱4, 905. 00	₱98. 10
Bureau of Education	1	150. 00			2	₱60. 00			3	210. 00	18. 00
Bureau of Prisons	8	2, 250. 00							8	2, 250. 00	225. 00
Province of Batangas							2	₱600. 00	2	600. 00	60. 00
Province of Iloilo							2	924. 00	2	924. 00	92. 40
Mountain Province	1	400. 00							1	400. 00	
Province of Ambos Camarines			2	₱250. 00					2	250. 00	25. 00
City of Manila	3	600. 00							3	600. 00	60. 00
Province of Agusan			8	920. 00					8	920. 00	92. 00
University of the Philippines					3	90. 00			3	90. 00	9. 00
Total	32	8, 305. 00	10	1, 170. 00	5	150. 00	4	1, 524, 00	51	11, 149. 00	679. 50

No. 11.—*Sale of Bureau animals.*

Credit.	Horses.		Mules.		Cattle.		Carabaos.		Swine.		Goats.		Total.	
	Number.	Price.	Number.	Price.	Number.	Price.	Number.	Price.	Number.	Price.	Number.	Price.	Number.	Price.
Alabang stock farm	14	₱1, 800. 00	2	₱500. 00	10	₱670. 00			27	₱895. 00	13	₱85. 00	66	₱3, 950. 00
La Carlota experiment station					3	280. 00					1	10. 00	4	290. 00
Trinidad stock farm	1	150. 00			5	300. 00							6	450. 00
Trinidad garden			2	1, 000. 00	6	660. 00							8	1, 660. 00
Lamao, Bataan									2	55. 00			2	55. 00
Ilagan tobacco station									1	35. 00			1	35. 00
Tanculan, Bukidnon					1	60. 00							1	60. 00
Sisiman, Bataan					4	160. 00							4	160. 00
Total for division of animal husbandry	15	1, 950. 00	4	1, 500. 00	29	2, 130. 00			30	985. 00	14	95. 00	92	6, 660. 00

VETERINARY DIVISION.

Pandacan quarantine station					8	₱555.00							8	₱555.00
San Lazaro immunizing station							2	₱96.00					2	96.00
Research laboratory					7	105.00							7	105.00
Total veterinary division					15	660.00	2	96.00					17	756.00
Grand total													109	7,416.00

No. 12.—*Summary of public breeding.*

Station.	Property number of sire.	Time at station.	Services.	Foals.	Total for station.	
					Services.	Foals.
Virac	D. of A	July 1, 1912	119	40		
	B-12	do	68	20		
	40	do	13	26		
	A-121	do		6		
	123	Feb. 6, 1913	111		311	92
Vigan	73	July 1, 1912	55		55	
Ilagan	864	do	36		36	
Larena	121	do	68	2		
	185	do	52		120	2
Dumaguete	122	Dec. 1, 1912	28		28	
Payo, Viga	166	Feb. 16, 1913	39	2		
	117	do	21	3		
	116	do	35	14		
	184	do	29	4	124	23
Batangas	A-107	Nov. 5, 1912	126			
	A-21	Nov. 2, 1912	113			
	B-79	do	116			
	A-106	Feb. 24, 1913	61			
	63	Nov. 30, 1912	17		433	
Iloilo	B-101	Oct. 12, 1912	2		2	
Bangued	B-1	July 1, 1912	101		101	
La Carlota	L-118	do	3	2	3	2
Alabang	A-107	July-Nov.	4			
	126	July 1, 1912	4			
	119	do	27		35	
Total (25)					1,248	119

This list does not include data on other public breeding animals such as bulls, boars, etc.

No. 13.—*Bureau animals born during the year.*

Station.	Horses.	Cattle.	Carabaos.	Swine.	Goats.	Guinea pigs.	Rabbits.	Total.
Alabang	20	32		43	66			161
La Carlota	16	47	8		11			82
Trinidad		36						36
Singalong	2							2
Laboratory						456	65	521
Bukidnon		3						3
Lamao				2				2
Veterinary mares	2							2
Total	40	118	8	45	77	456	65	809

No. 14.—*Deaths of Bureau animals during the year.*

Station.	Horses.	Mules.	Burros.	Cattle.	Sheep.	Carabaos.
Alabang stock farm	17			23	1	
Trinidad stock farm				10		
La Carlota experiment station	3			7	1	2
Lamao experiment station			1			
Research laboratory	9	1		135	2	4
Singalong experiment station	1	2		2		
Ilagan tobacco station						1
San Lazaro immunizing station		2		1		1
Field	20			1		
Total	50	5	1	179	4	8

Station.	Goats.	Swine.	Monkeys.	Rabbits.	Guinea pigs.	Total.
Alabang stock farm	11	28				80
Trinidad stock farm						10
La Carlota experiment station	8	4				25
Lamao experiment station		7				8
Research laboratory	5	1	96	17	364	634
Singalong experiment station		3				8
Ilagan tobacco station		6				7
San Lazaro immunizing station						4
Field	1					22
Total	25	49	96	17	364	798

NOTE.—Nearly the entire number of deaths occurring at the research laboratory was experimental animals.

No. 15.—*Number and location of Bureau animals at end of year.*

Station.	Horses.	Cattle.	Goats.	Mules.	Carabaos.	Swine.	Sheep.
Alabang stock farm	75	178	99			42	13
La Carlota experiment station	46	159	16	1	26	3	
Trinidad stock farm	3	116					
Research laboratory	28	56	2				5
Iloilo demonstration station	1	7	2			2	
Singalong experiment station	10			6		9	
Ilagan tobacco station	3				3		
Pandacan quarantine station		8					
Provincial breeding stations	23	3	4			5	
Bukidnon		16				1	
Lamao experiment station		4		1			
Bodega	53			11			
Total	242	547	123	19	29	62	18

Station.	Burros.	Deer.	Rabbits.	Monkeys.	Guinea pigs.	Total.
Alabang stock farm						407
La Carlota experiment station						251
Trinidad stock farm						119
Research laboratory		3	22	19	357	492
Iloilo demonstration station						12
Singalong experiment station						25
Ilagan tobacco station						6
Pandacan quarantine station						8
Provincial breeding stations						35
Bukidnon						17
Lamao experiment station	7					12
Bodega						64
Total	7	3	22	19	357	1,448

No. 16.—*Distribution of Philippine Agricultural Review, fiscal year 1912–13.*

	English.	Spanish.
Paid subscriptions	172	193
Exchanges, foreign and local periodicals	205	78
Bureau of Education	322	----------
Government officials and free subscriptions	1,224	1,167
Total monthly distribution	1,923	1,438
Grand total monthly distribution	3,361	

No. 17.—*Complete mailing list of the Philippine Agricultural Review, fiscal year 1912–13.*

Manila:	
English edition	597
Spanish edition	182
United States:	
English edition	424
Spanish edition	4
Foreign:	
English edition	391
Spanish edition	70
Provincial:	
English edition	511
Spanish edition	1,182
Total for Manila, United States, and foreign	1,668
Total for provinces	1,693
Grand total	3,361
Total for English edition only	1,923
Total for Spanish edition only	1,438

No. 18.—*Cost of publishing and delivering the Philippine Agricultural Review, fiscal year 1912–13.*

Date.	Copies.		Printing.		Wrappers.	Postage.
	English.	Spanish.	English.	Spanish.		
July	2,500	3,000	₱790.95	₱794.85	----------	₱37.96
August	2,500	3,000	668.85	679.30	----------	13.34
September	2,000	2,500	554.90	606.75	----------	13.00
October	2,000	2,500	458.78	534.30	----------	12.04
November	2,000	2,000	724.66	613.20	----------	23.24
December	2,200	2,200	770.07	693.55	₱280.65	17.38
January	2,000	2,000	640.90	533.10	----------	26.22
February	2,000	2,000	766.52	638.60	----------	19.14
March	2,000	2,000	733.23	570.90	----------	18.47
April	2,000	2,000	584.80	634.05	----------	1.30
May	2,000	2,000	711.31	589.70	----------	29.37
June	2,200	2,200	719.87	607.40	----------	33.35

	Copies.	Cost.
Index to Volume V (English)	1,000	₱246.12
Title page for Volume V (English)	200	6.55

No. 19.—*Paid subscriptions to the Philippine Agricultural Review, fiscal year 1912–13.*

	English.	Spanish.
United States	16	1
Guam	1	----------
Hawaii	1	----------
PHILIPPINE ISLANDS.		
Manila	48	37
Agusan	1	1
Albay	----------	3
Antique	----------	2
Bataan	----------	1
Batangas	1	7
Bohol	----------	1
Bulacan	----------	5
Cagayan	1	2
Camarines	1	2
Capiz	1	4
Cavite	5	1
Cebu	2	4
Ilocos Norte	----------	2
Iloilo	3	6
Isabela	1	----------
Laguna	4	4
La Union	7	1
Leyte	5	9
Masbate, Sorsogon	2	4
Mindoro	2	5
Misamis	2	6
Moro	23	5
Mountain	----------	1
Nueva Ecija	3	1
Nueva Vizcaya	----------	1
Occidental Negros	2	13
PHILIPPINE ISLANDS—cont'd.		
Oriental Negros	1	2
Palawan	1	5
Pampanga	4	16
Pangasinan	2	4
Rizal	1	7
Samar	4	4
Sorsogon	----------	6
Surigao	2	2
Tarlac	----------	4
Tayabas	1	11
Zambales	2	1
FOREIGN.		
Australia	2	----------
Belgium	1	----------
Ceylon	1	----------
Cuba	2	----------
England	2	----------
Federated Malay States	3	----------
Germany	1	----------
India	3	----------
Indo-China	1	----------
Italy	----------	1
Japan	1	----------
New Caledonia	1	----------
New Guinea	1	----------
Switzerland	2	----------
Timor	1	----------
Venezuela	----------	1

No. 20.—*Planotype work, fiscal year 1912–13.*

	Work orders.
Manuscript	111
Tabular	87
Cards, etc	75
Total work orders	273
Total copies printed for 273 work orders	253,715
Work orders by divisions:	
Veterinary	118
Finances and property	56
Clerical	42
Demonstration and extension	14
Horticulture	12
Publications	11
Animal husbandry	8
Statistics	6
Agronomy	5
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Total	**273**

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[1] On leave.

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